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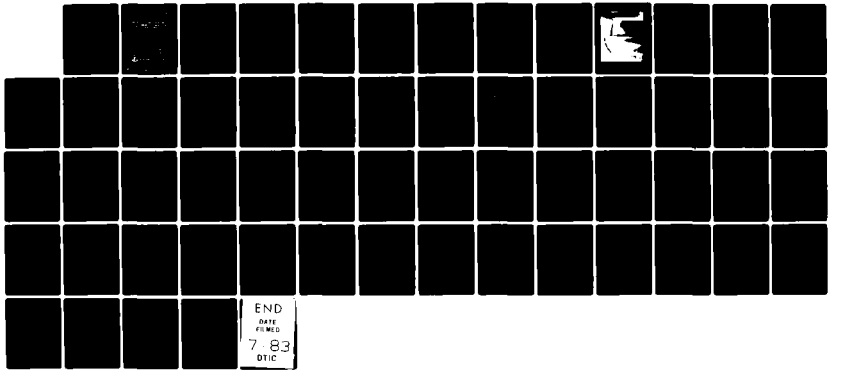

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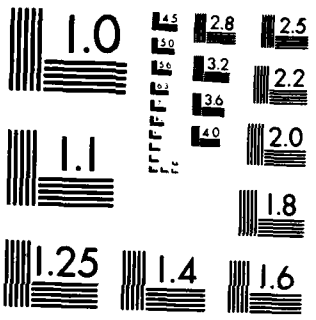

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LASER DOPPLER VELOCIMETER MEASUREMENTS OF THE TWO-DIMENSIONAL BOUNDARY LAYERS ON A PROJECTILE SHAPE AT MACH 3

BY JEFFREY L. GORNEY WILLIAM J. YANTA DONALD W. AUSHERMAN

STRATEGIC SYSTEMS DEPARTMENT

SEPTEMBER 1982

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Two-dimensional boundary layer velocity profiles, as well as pressure distributions, turbulence intensities, and Reynolds stresses were measured on a six-caliber secant-ogive model for angles of attack of 0°, $\pm 2^{\circ}$. Test conditions were a Reynolds number of 2.7×10^{6}/ft, Mach number of 3.02, and a P_o of 20 psia.

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FOREWORD

An extensive data base on a six-caliber secant-ogive cylinder model with two different rotating band configurations was generated in the NSWC/WO Supersonic Tunnel #2 at Mach 3.02. Pressure and Laser Doppler Velocimeter (LDV) data were collected at four axial stations, at three angles-of-attack (0°, ±2°), with and without the rotating bands. Spark shadowgraph photography was also obtained.

The authors would like to express their appreciation to the program sponsor, Dr. Walter Sturek, and the test monitor, Lyle Kayser, of the U.S. Army Ballistics Research Laboratory. The technical expertise demonstrated by NSWC personnel - Mary Ellen Falusi, Steven Cothran, and Robert Marshall, was also deeply appreciated.

Approved by:

D. M. Morrison for

C. A. FISHER, Head
Weapon Dynamics Division

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INTRODUCTION

This paper summarizes the results of a test performed in the Naval Surface Weapons Center/White Oak (NSWC/WO) Supersonic Wind Tunnel #2 on a six-caliber secant-ogive cylinder with two rotating band configurations.

The objective of this wind tunnel test was to provide a pressure and boundary layer profile data base for use in validating flowfield prediction codes for projectiles at small angles-of-attack. In particular, data were obtained which would allow for an evaluation of the effects of rotating band configurations on projectile aerodynamics.

The approach taken in the test was to measure the local wall pressures at thirteen axial locations near the rotating band, and to use a 2-D Laser Doppler Velocimeter (LDV) to measure velocity profiles at four axial stations. These tests were conducted under the sponsorship of the U.S. Army Ballistics Research Laboratory (BRL).

TEST FACILITY AND CONDITIONS

This test was conducted in the NSWC Supersonic Tunnel #2, a 16-inch x 16-inch cross-section, horizontal tunnel capable of operating over a Mach number range from 0.3 to 5.02, with a supply pressure ranging from 0.5 to 15 atmospheres. The tunnel working medium is high pressure air. Two modes of operation are available: (1) a blow-down mode from an air storage system; or (2) a continuous "recirculating" mode.

For this test, the continuous mode was used, with a Mach number of 3.02 and a Reynolds number of approximately 2.7×10^6/ft. The nominal supply pressure and temperature were 20 psia and 130°F, respectively.

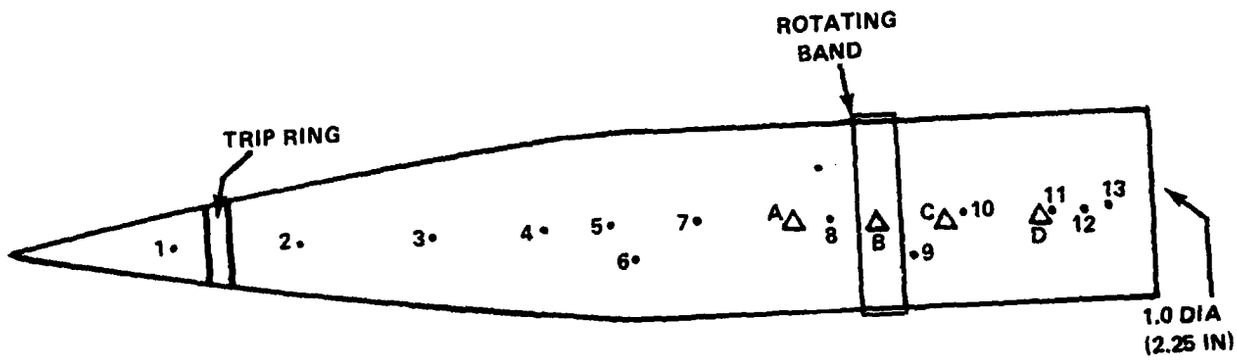
MODEL AND INSTRUMENTATION

The model used for this test was a six-caliber secant-ogive cylinder as shown in Figure 1. It consisted of a three-caliber nose section and a three-caliber straight, cylindrical afterbody. The model was 13.5 inches in length, with a 2.25 inch base diameter. Furthermore, two rotating bands of 0.5-inch width, .040 inch and .080 inch height were located, and used individually, at an X/D of 4.39 on the model afterbody.

The model was equipped with thirteen static pressure ports aligned along the length of the model. Eleven of the ports were in one ray, and the remaining two were offset 22-1/2° from the ray. This is illustrated in Figure 1.

Small plastic tubing connected the pressure ports to a bank of thirteen 5.0 psia transducers. The transducer output was then connected to the DARE (Data Acquisition and Recording Equipment) system.

In order to ensure a fully turbulent boundary layer at the measurement stations, a trip ring of 0.25-inch width was used. It was centered at an X/D of approximately 1.25. This 0.006-inch thick trip ring had two rows of .030-inch diameter steel balls spotwelded to it. There were 30 balls equally spaced to a



PRESSURE PORT NO.	X/D
1	.889
2	1.556
3	2.222
4	2.791
5	3.129
6	3.222
7	3.556
8	4.222
9	4.556
10	4.889
11	5.333
12	5.611
13	5.778

LDV SURVEY STATION	X/D
A	4.00
B	4.39
C	4.70
D	5.25

FIGURE 1. MODEL GEOMETRY

row, with the back row staggered from the front row. This trip ring was used on all pressure and LDV runs. A photograph of the model mounted in the tunnel is shown in Figure 2.

For the flowfield velocity measurements of this test, a two-dimensional forward scatter LDV system was used. The focal volume was calculated to have a diameter of 0.007 inches. A complete system schematic can be found in Figure 3, and a description can be found in Reference 1.

TEST MATRIX AND PROCEDURES

The LDV test matrix included flowfield surveys at four axial stations, at three angles-of-attack (0°, +2°), and for two rotating band configurations. The LDV surveys were taken at $X/\overline{D}$ locations of 4.00, 4.39, 4.70, and 5.25. Of the four survey stations, one was located in front of the rotating band, another was directly over it, and the final two were behind it.

It was found that LDV measurements could be made to within 0.020 inches from the model wall. From 0.020 inch to 0.100 inch from the wall, samples were taken every 0.005 inch; from 0.100 inches to 0.200 inch, samples were taken every 0.010 inch. The data showed that the boundary layer was approximately 0.15-inch thick at $\alpha = 0°$.

DATA REDUCTION

The 2-D LDV system was utilized to obtain the boundary layer velocity profiles. Each profile consisted of approximately 25 survey points. At each survey point, 2500 data samples were taken and recorded on magnetic tape. At the completion of the run, a Data General Nova II minicomputer was used to compute a mean velocity, the standard deviations of the velocities, and the cross-velocity correlations.

These values are defined as:

$$\overline{U} = \frac{\sum_{i=1}^{N} U_i}{N} \qquad \overline{V} = \frac{\sum_{i=1}^{N} V_i}{N}$$

$$< U' > = \sqrt{\frac{\sum_{i=1}^{N} (U_i - \overline{U})^2}{N}} \qquad < V' > = \sqrt{\frac{\sum_{i=1}^{N} (V_i - \overline{V})^2}{N}}$$

$$\overline{U'\,V'} = \sum_{i=1}^{N} (U_i - \overline{U})\,(V_i - \overline{V})$$

1. Yanta, W. J., "A Three-Dimensional Laser Doppler Velocimeter (LDV) for Use in Wind Tunnels," Paper IEEE 79 CH 1500-8AES, presented at International Congress on Instrumentation in Aerospace Facilities, Monterey, California, September 1979.

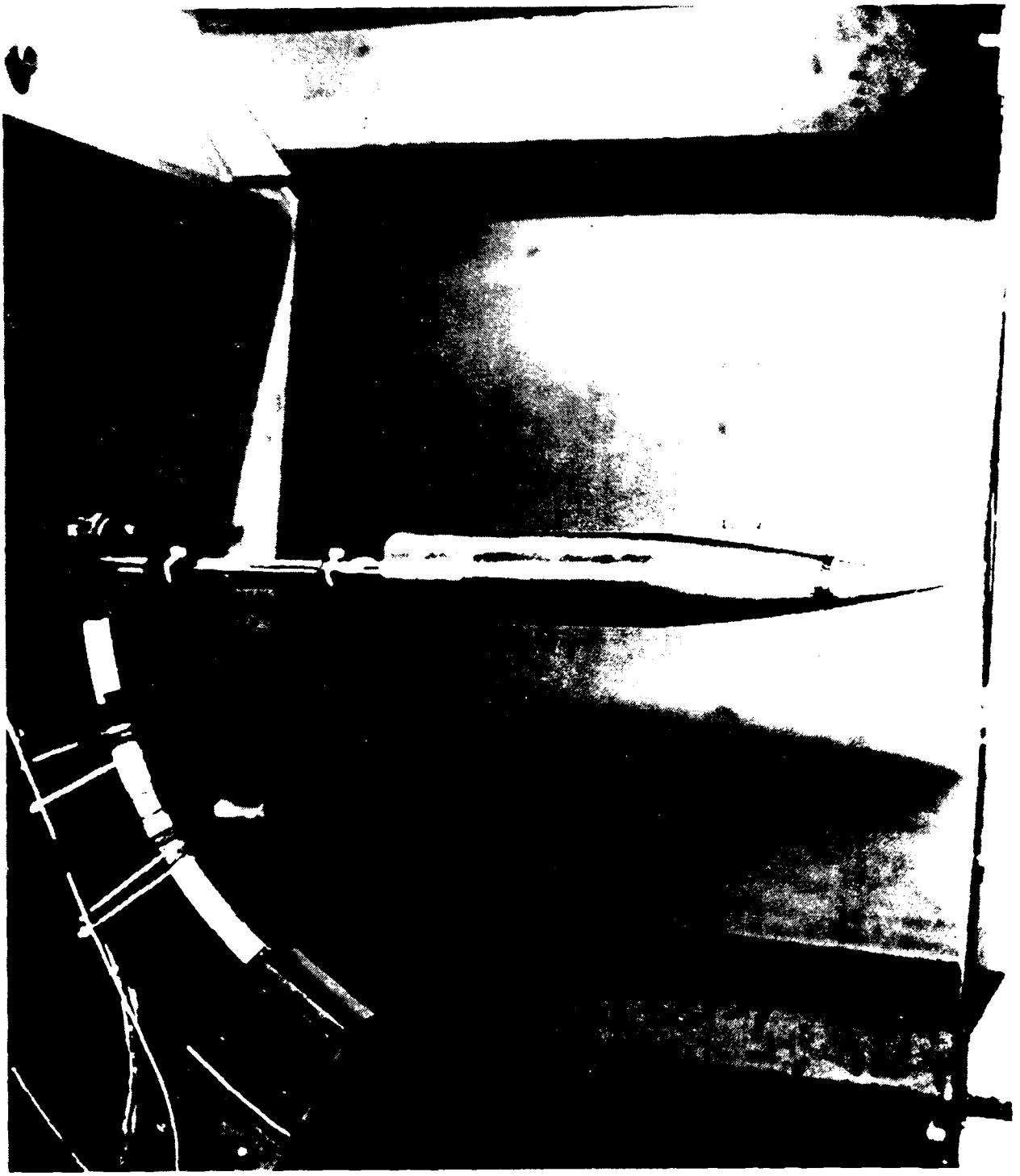


FIGURE 2. PRESSURE MODEL MOUNTED IN NSWC'S SUPERSONIC TUNNEL 2

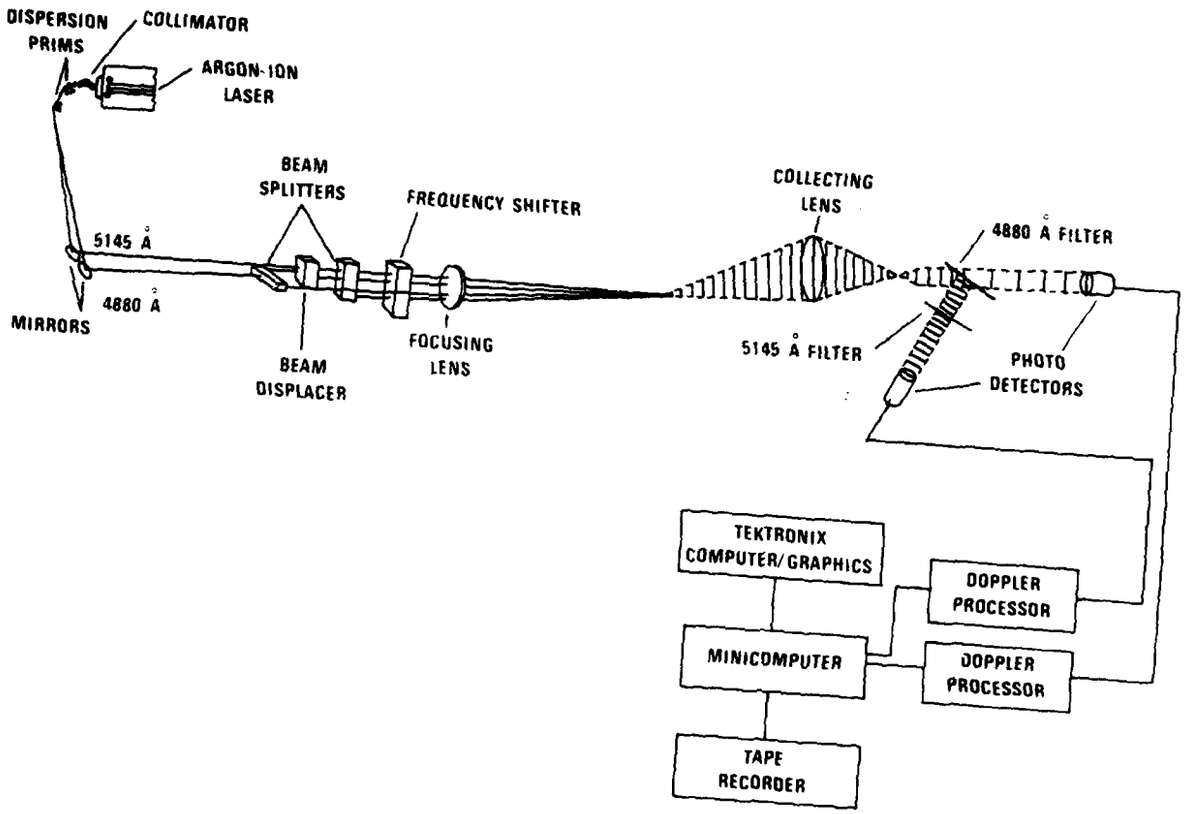


FIGURE 3. SCHEMATIC OF 2-D LDV

Routines were available to plot the velocity values versus the y-coordinate values.

RESULTS

Appendices A, B, and C provide the results gathered from this test.

Appendix A gives the velocity, turbulence intensity, and Reynolds stress profiles. This information was taken at four axial stations, three angles of attack, and two rotating band configurations.

Appendix B details the surface pressure data. Figures B-1(a-n) plot pressure coefficients vs. roll angle at three angles of attack, four axial stations, with two rotating band configurations. Figure B-2 shows the plot of C_p vs. X/D at only 0° angle of attack, but with both rotating bands.

Appendix C provides a tabulated form of the same information given in Appendix A.

NOMENCLATURE

A_∞	- Speed of sound (free stream)
C_p	- Pressure coefficient
D	- Base diameter (2.25 inches)
N	- Number of sample data points
P	- Local wall pressure
P_∞	- Free stream static pressure
R.b.	- Rotating band
U	- Local velocity parallel to model surface
USD	- U-Component velocity (standard deviation)
V	- Local velocity perpendicular to model surface
VSD	- V-Component velocity (standard deviation)
X	- Distance from nosetip measured parallel to model surface
XX	- Pressure port
Y	- Distance measured perpendicular to model surface
α	- Angle-of-attack
γ	- Ratio of specific heats = 1.4
< >	- RMS value
(-)	- Average value
(')	- Fluctuation from mean value

APPENDIX A
VELOCITY, TURBULENCE INTENSITY, REYNOLDS STRESS PROFILES

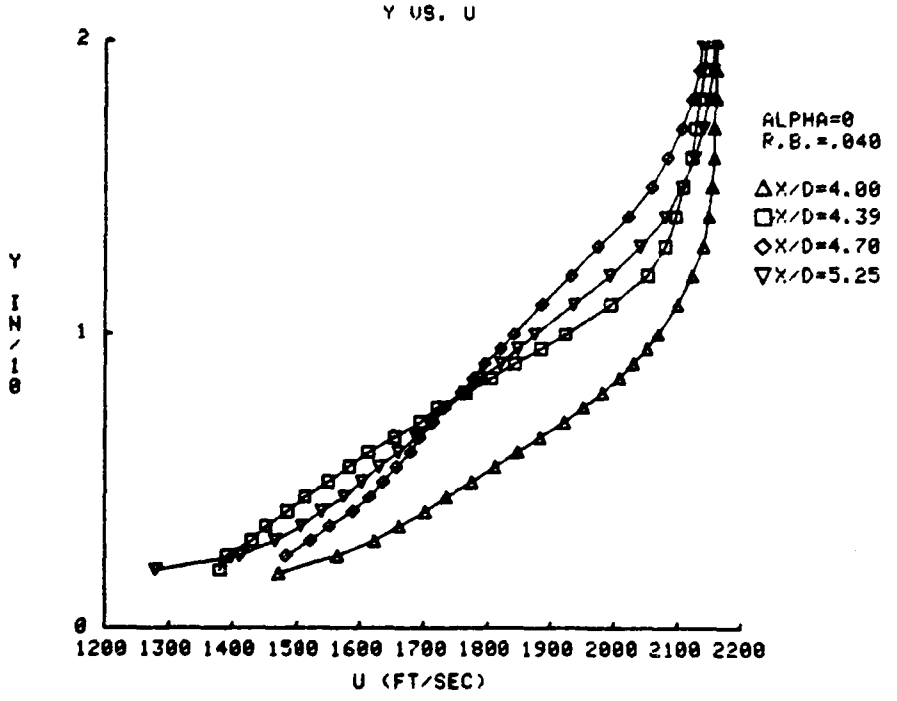


FIGURE A-1. U-COMPONENT OF VELOCITY

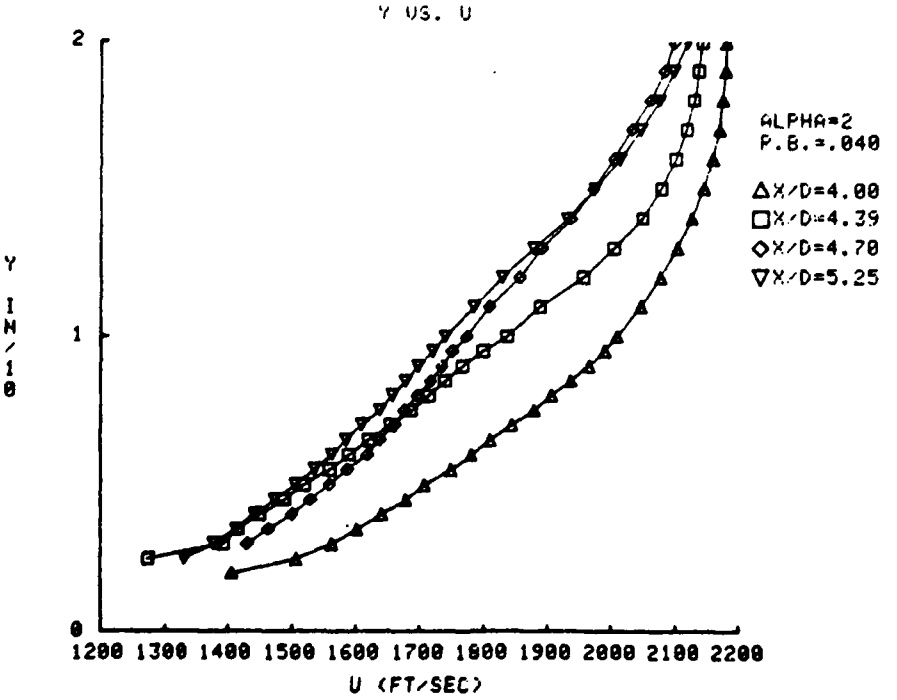
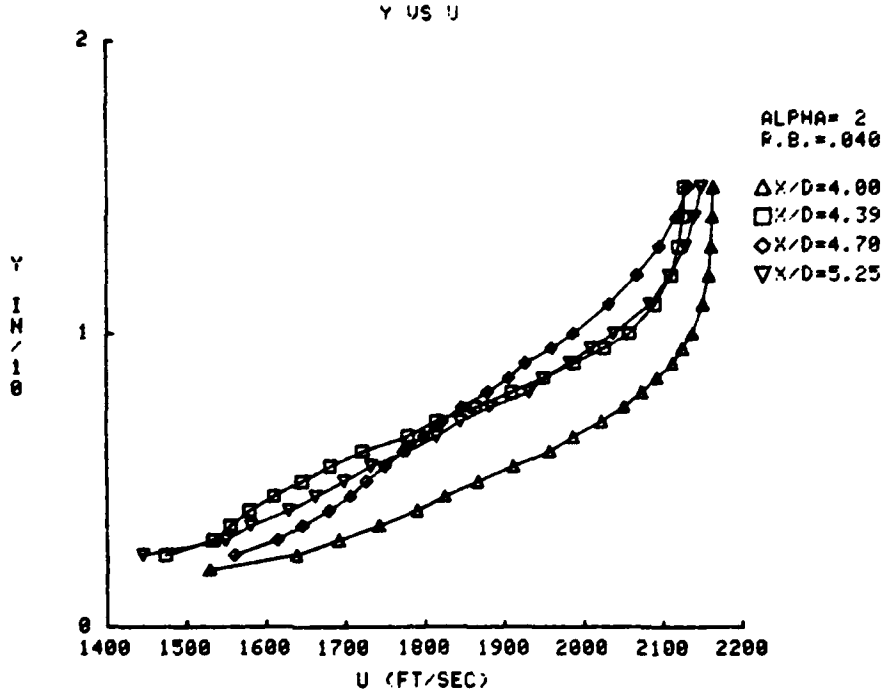


FIGURE A-2. U-COMPONENT OF VELOCITY ($\alpha = 2^{\circ}$, LEEWARD)



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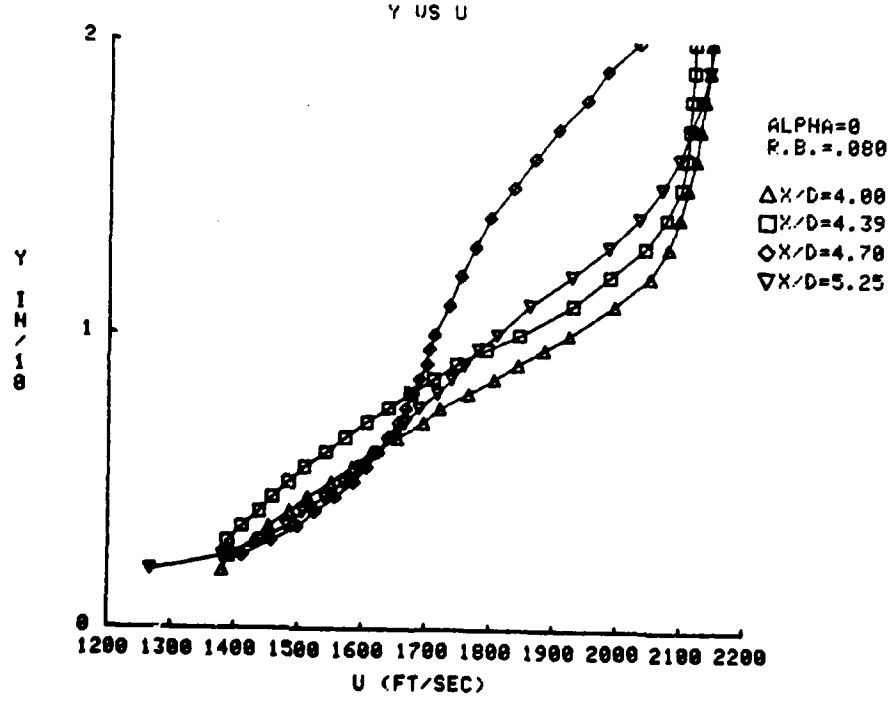


FIGURE A-4. U-COMPONENT OF VELOCITY

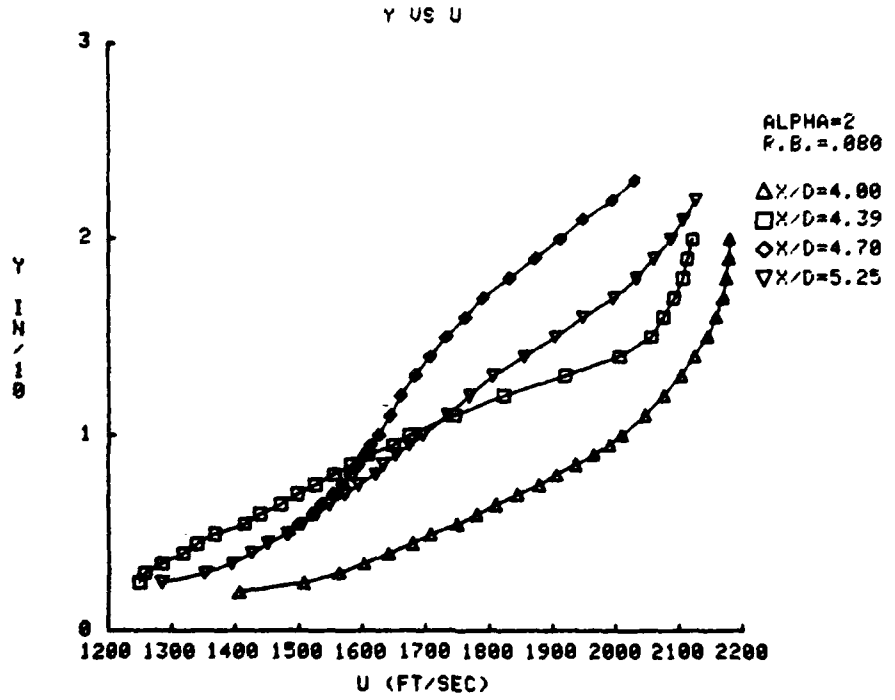


FIGURE A-5. U-COMPONENT OF VELOCITY ($\alpha = 2^{\circ}$, LEEWARD)

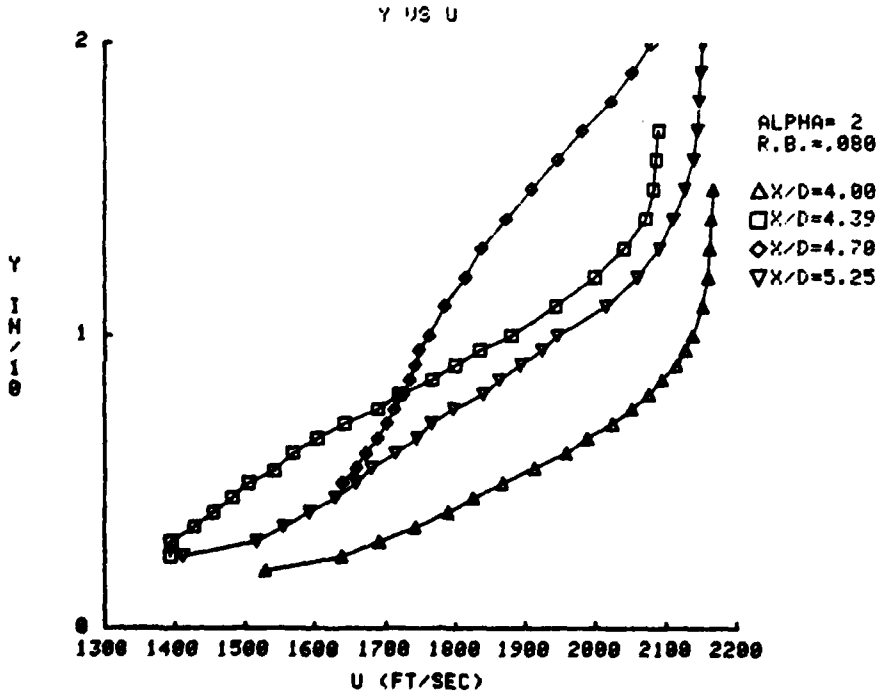


FIGURE A-6. U-COMPONENT OF VELOCITY ($\alpha = 2^{\circ}$, WINDWARD)

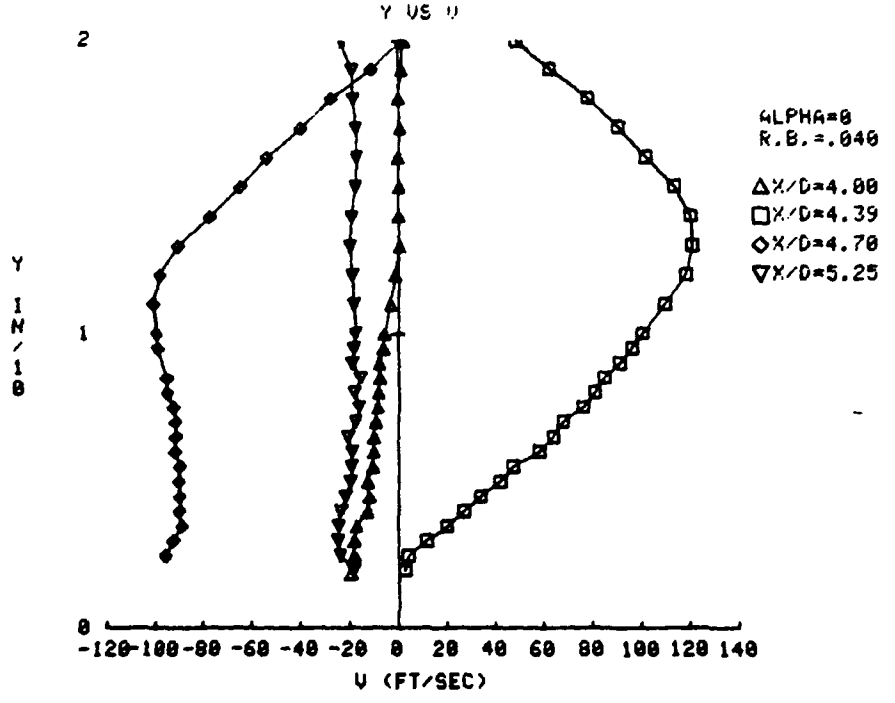


FIGURE A-7. V-COMPONENT OF VELOCITY

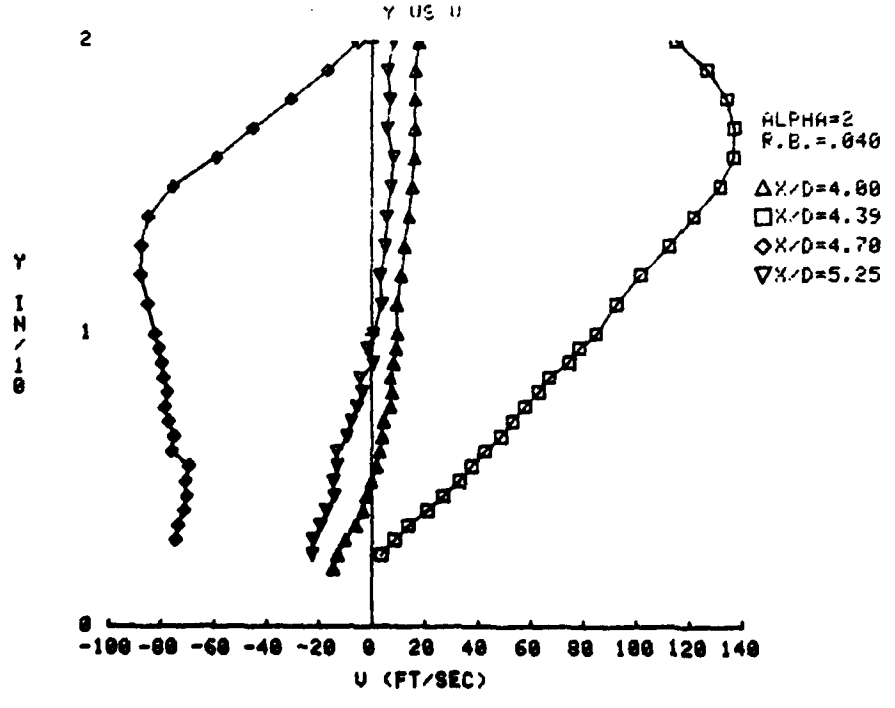


FIGURE A-8. V-COMPONENT OF VELOCITY ($\alpha = 2°$, LEEWARD)

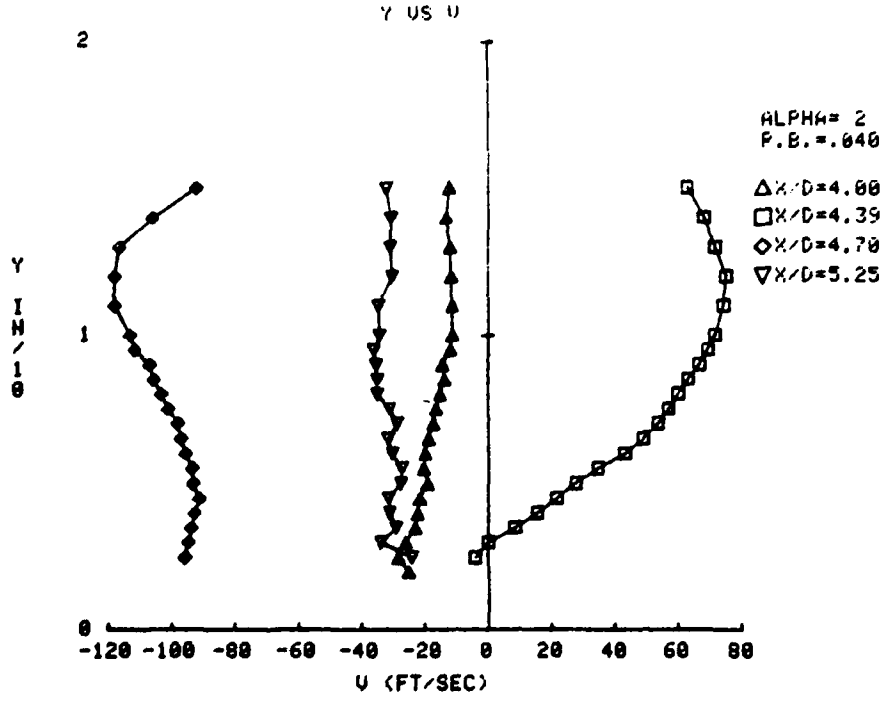


FIGURE A-9. V-COMPONENT OF VELOCITY ($\alpha = 2^{\circ}$, WINDWARD)

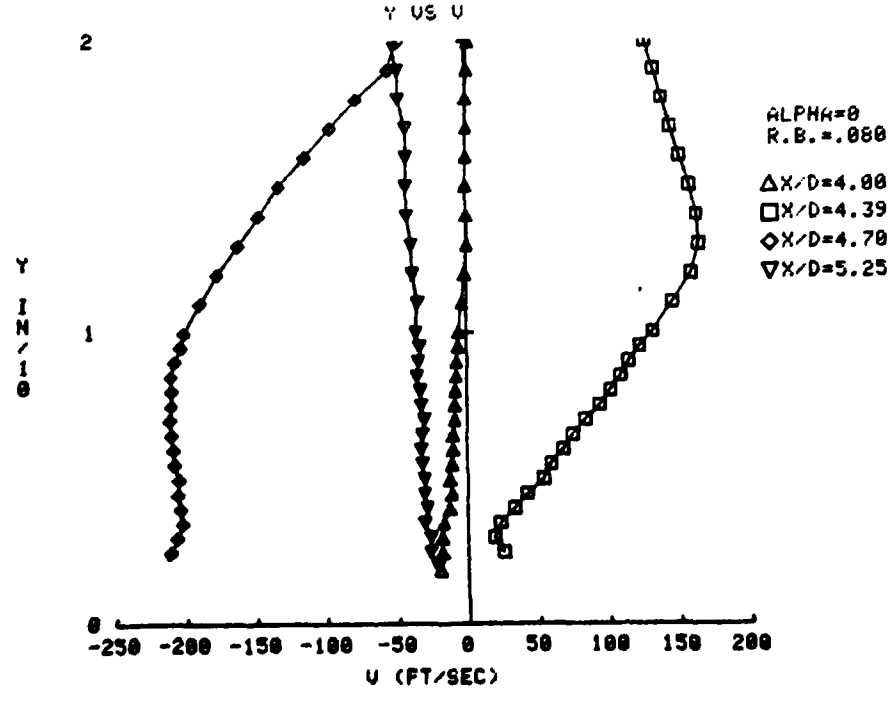


FIGURE A-10. V-COMPONENT OF VELOCITY

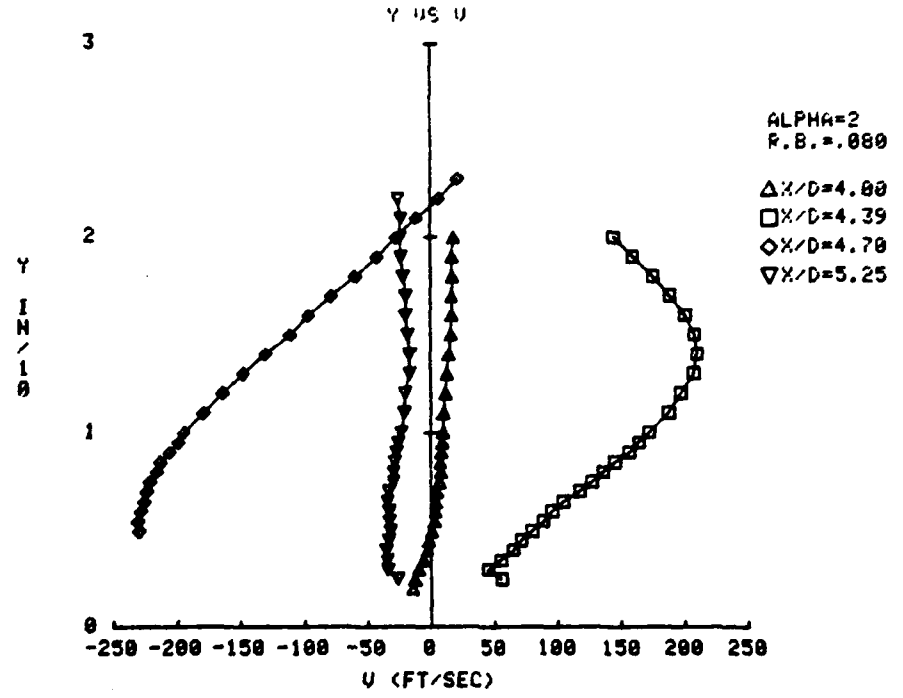


FIGURE A-11. V-COMPONENT OF VELOCITY ($\alpha = 2^{\circ}$, LEEWARD)

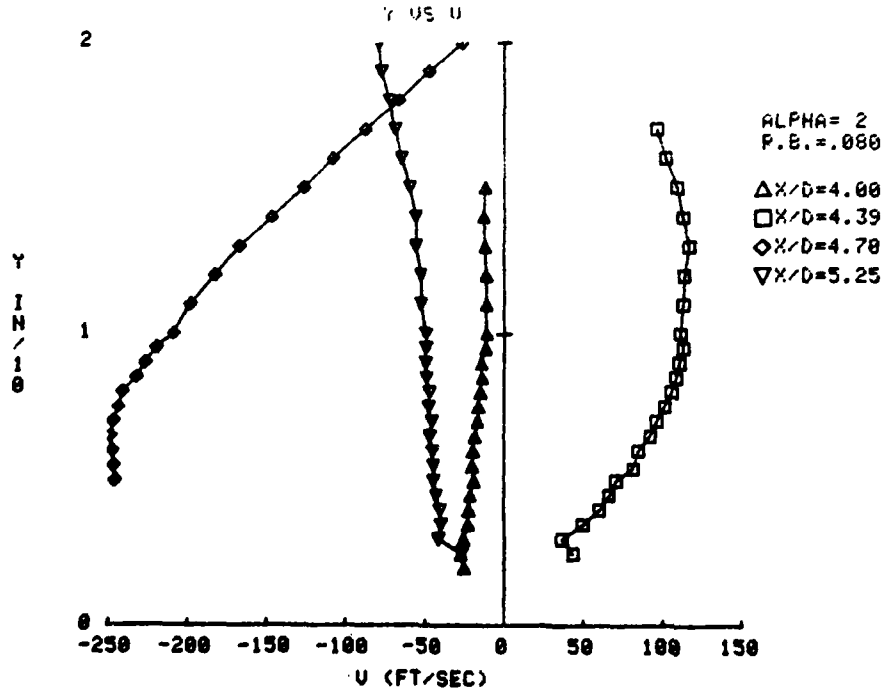


FIGURE A-12. V-COMPONENT OF VELOCITY ($\alpha = 2^{\circ}$, WINDWARD)

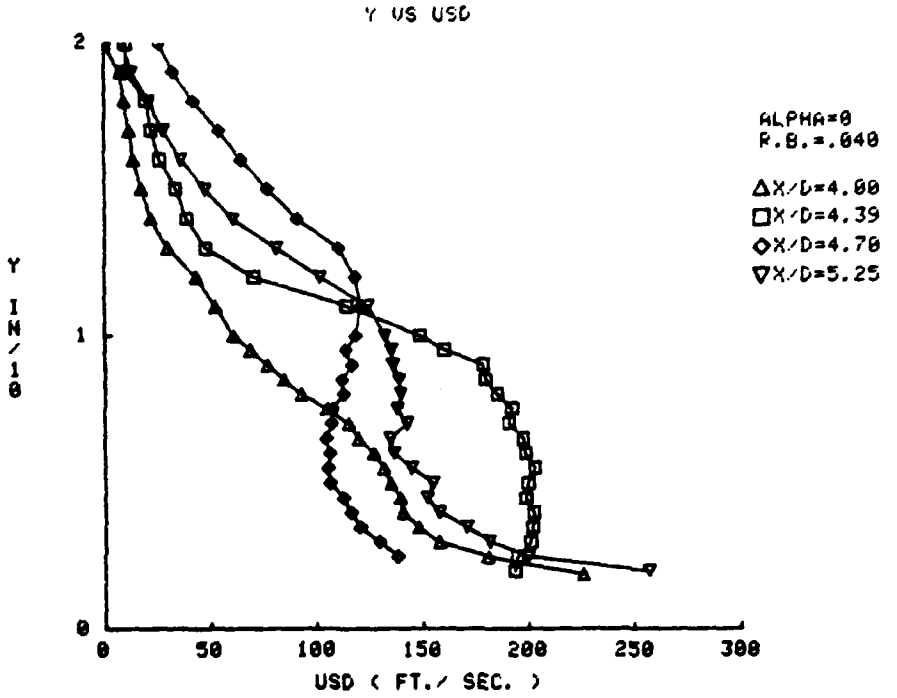
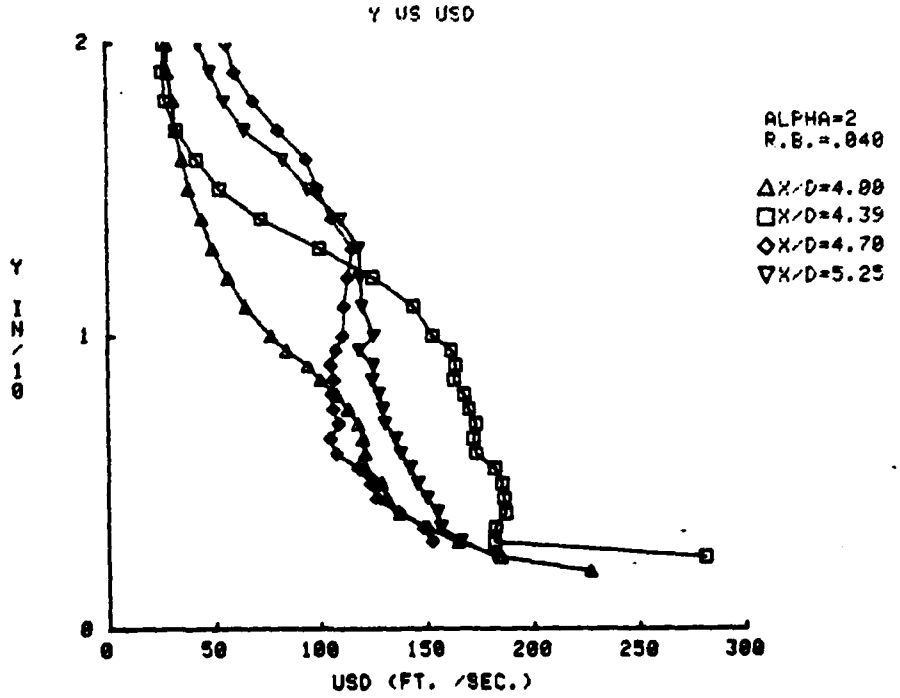


FIGURE A-13. U-COMPONENT STANDARD DEVIATIONS



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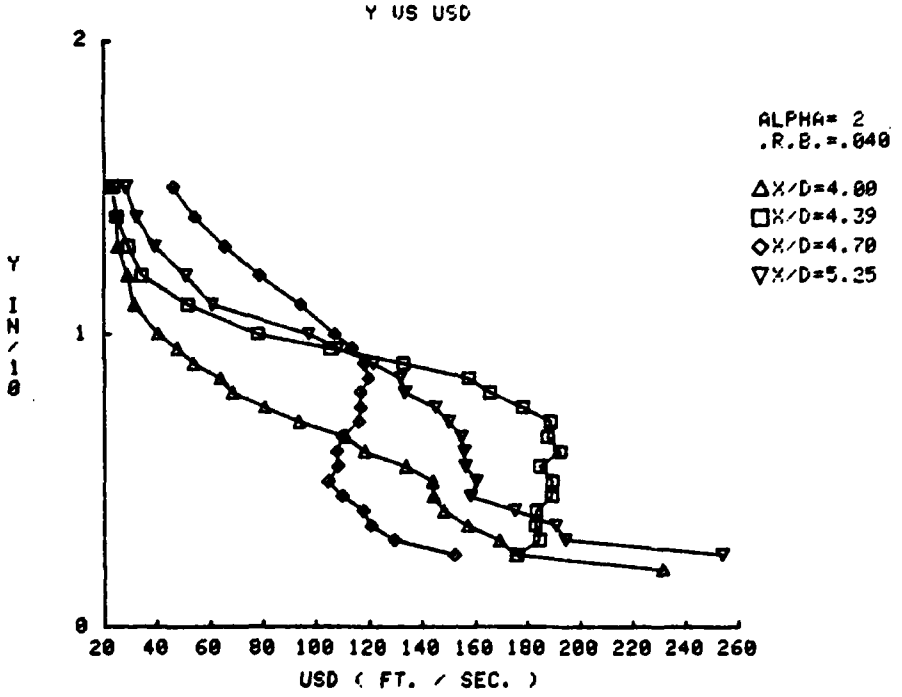

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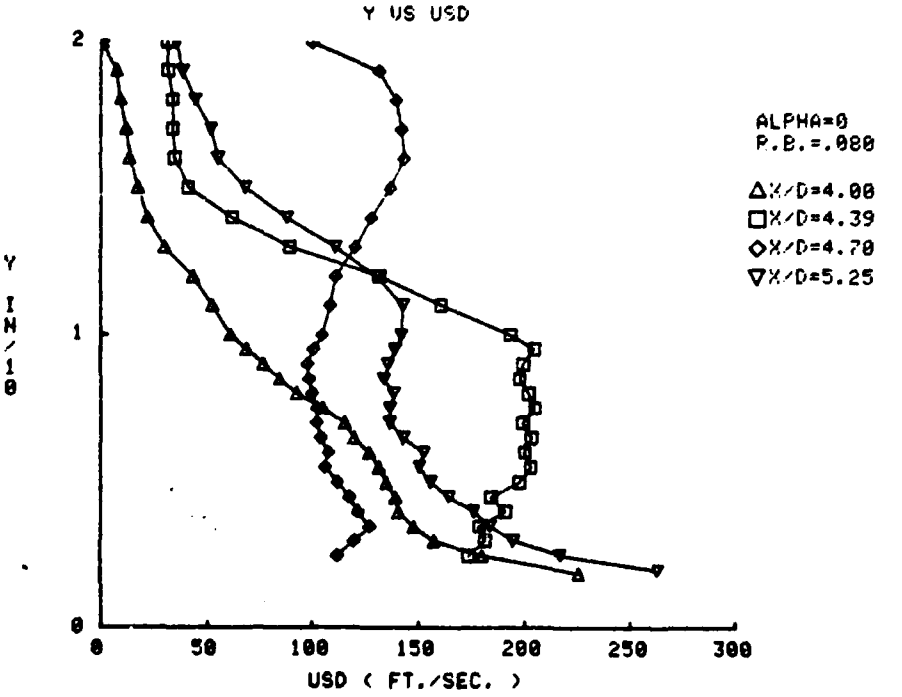

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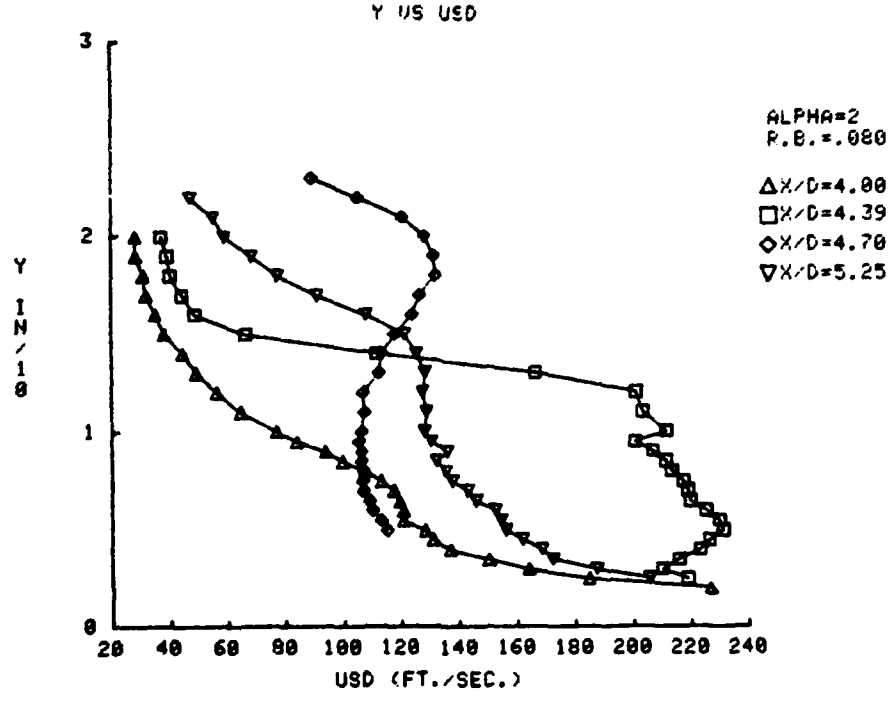

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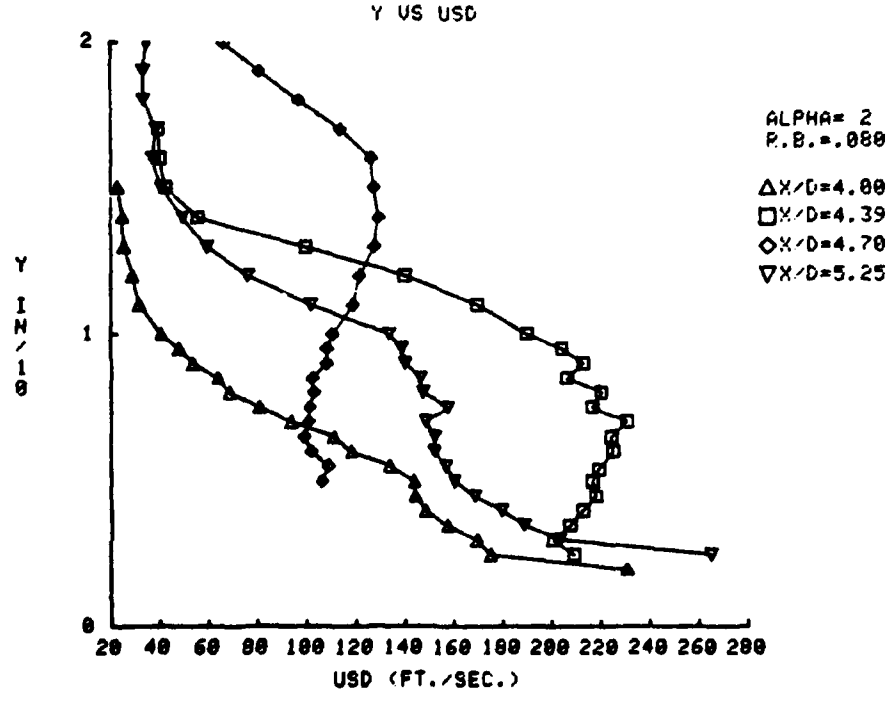

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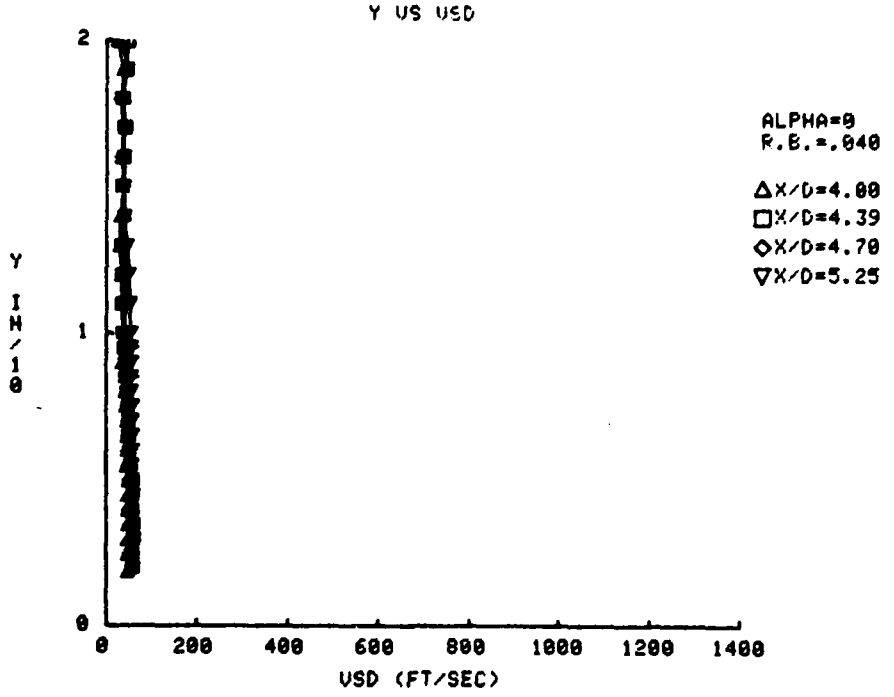

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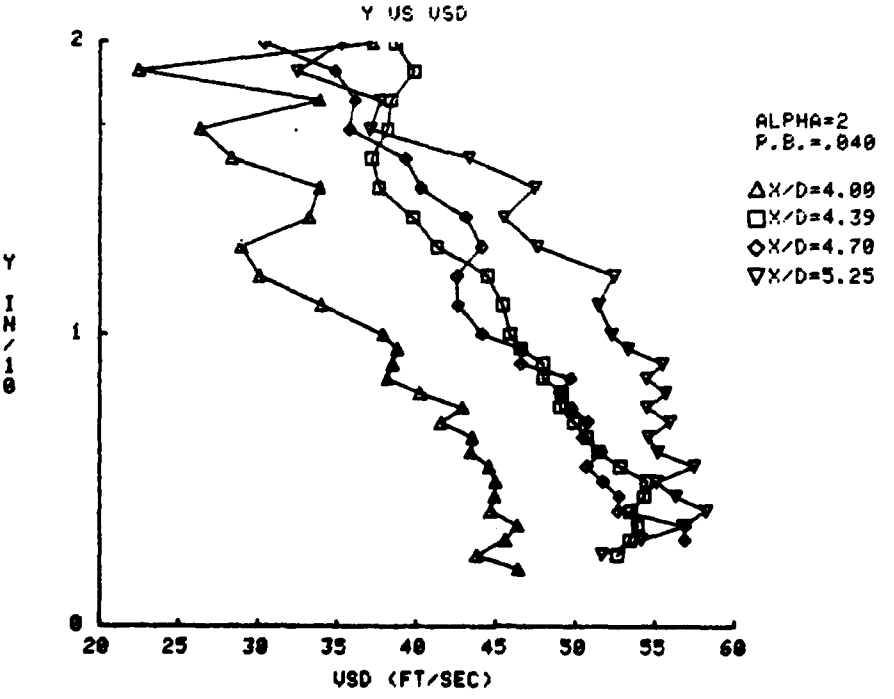

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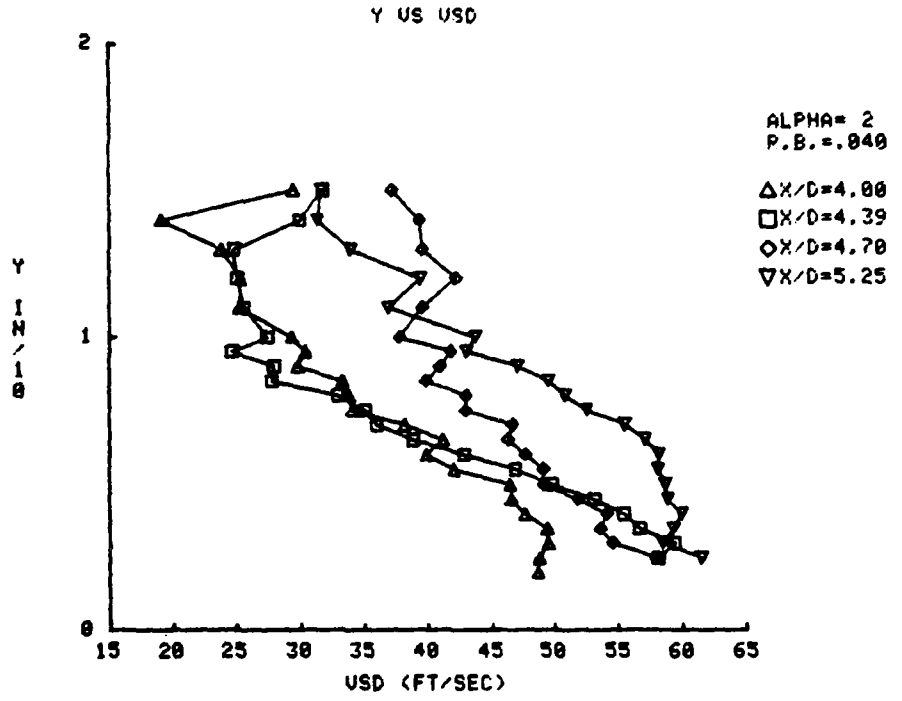

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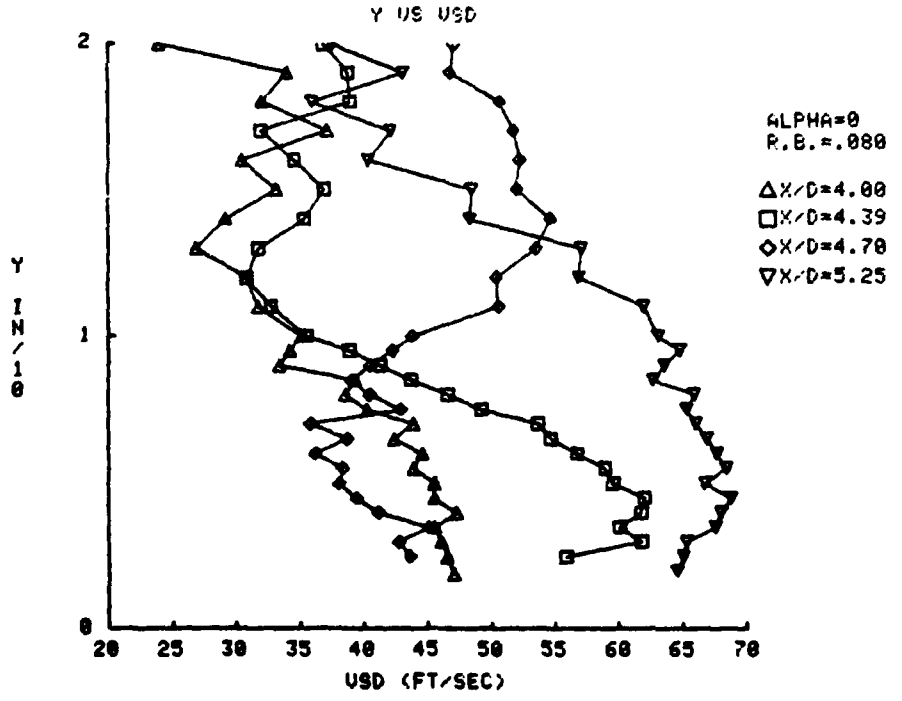

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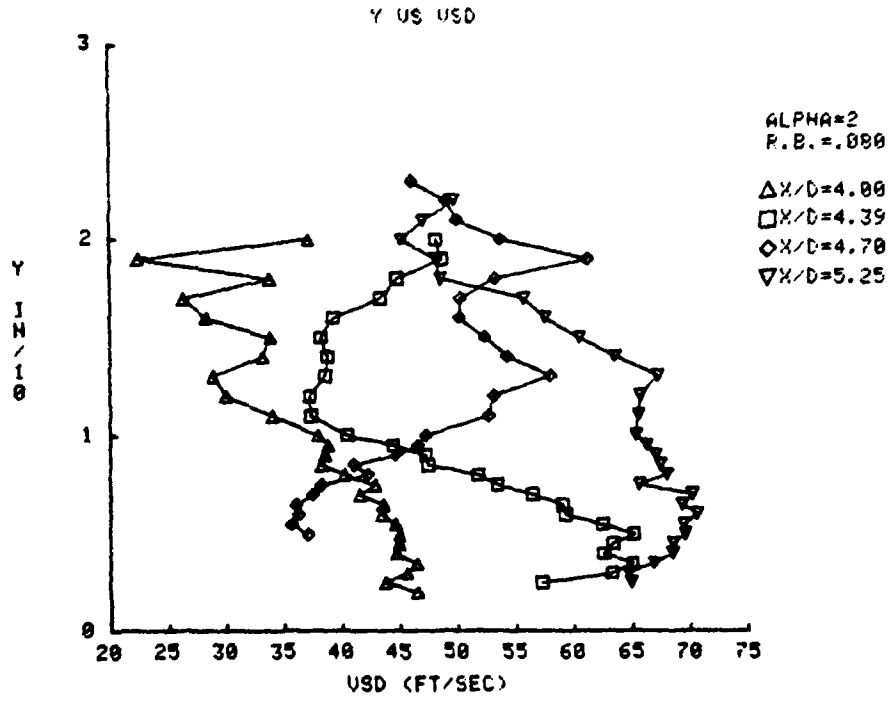

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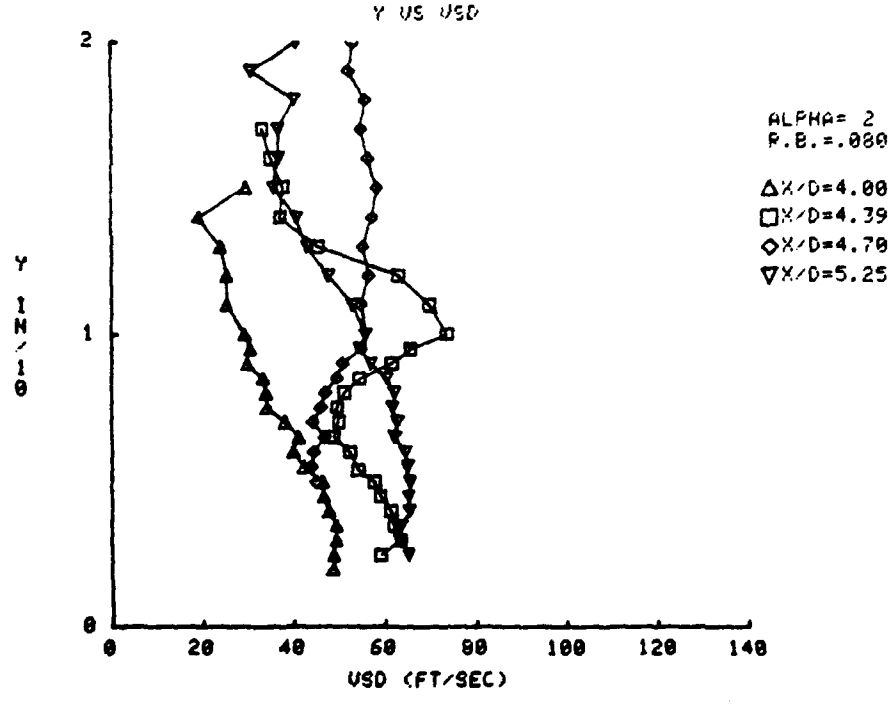

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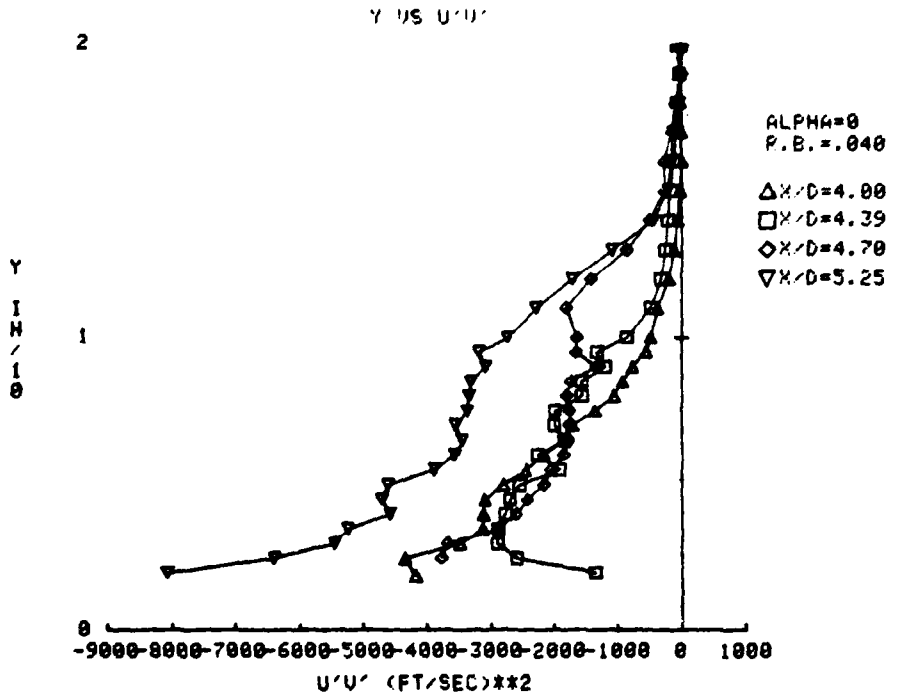

FIGURE A-25. REYNOLD'S STRESSES

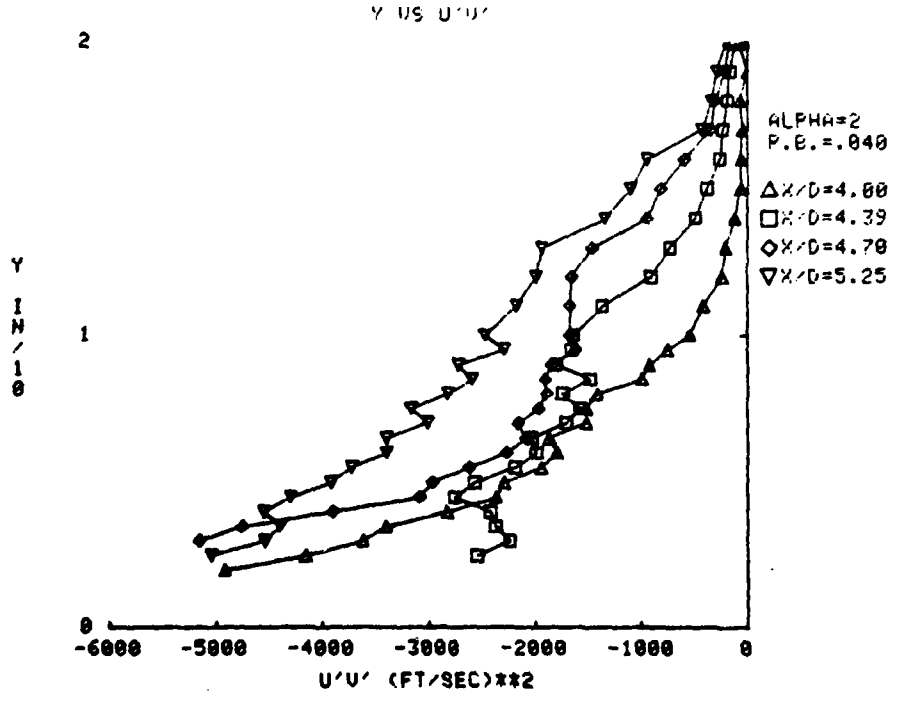

FIGURE A-26. REYNOLD'S STRESSES ($\alpha = 2^{\circ}$, LEEWARD)

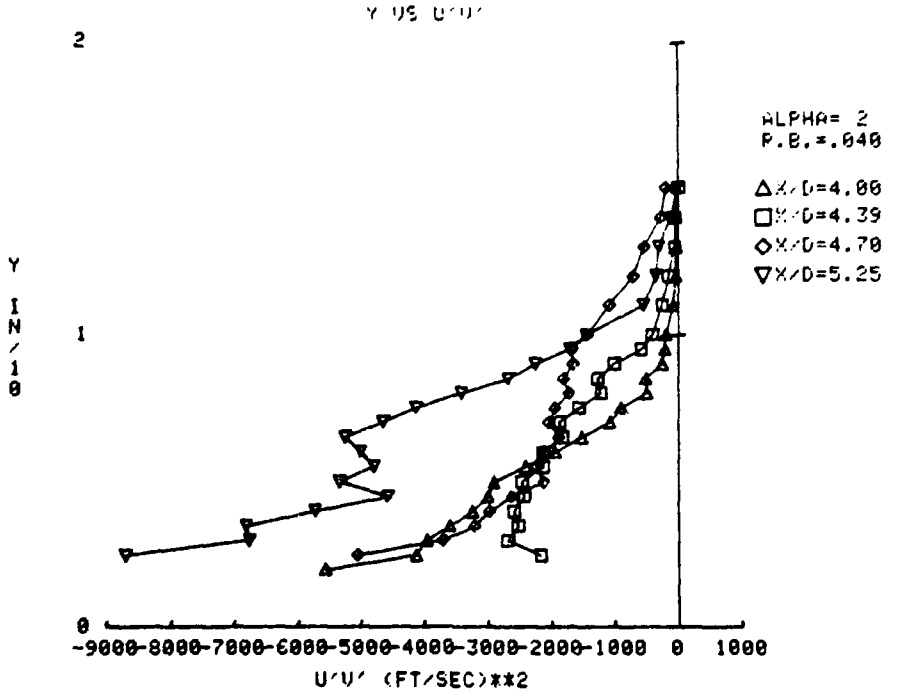

FIGURE A-27. REYNOLD'S STRESSES ($\alpha = 2^{\circ}$, WINDWARD)

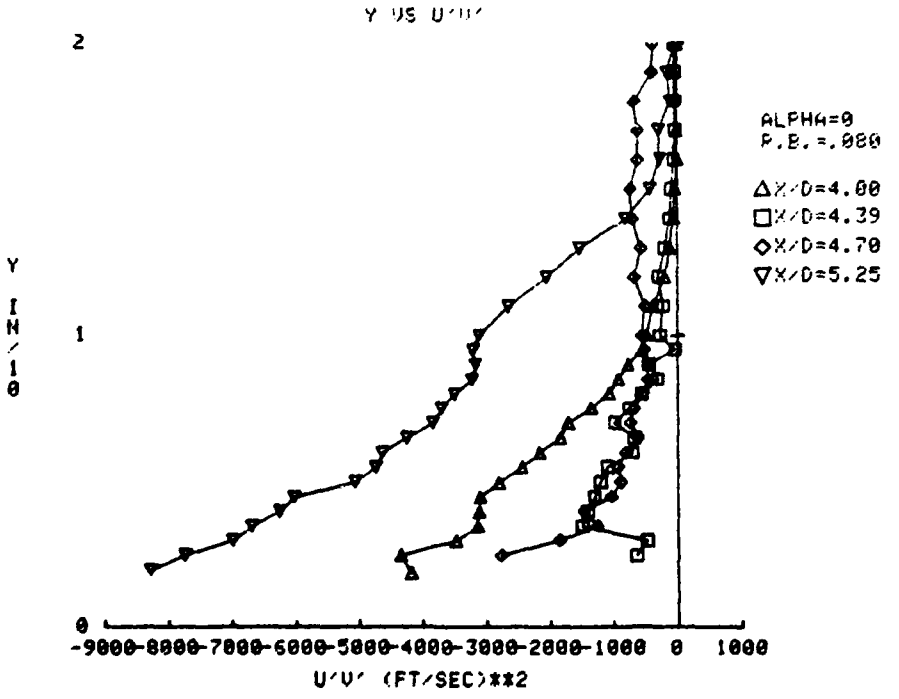

FIGURE A-28. REYNOLD'S STRESSES

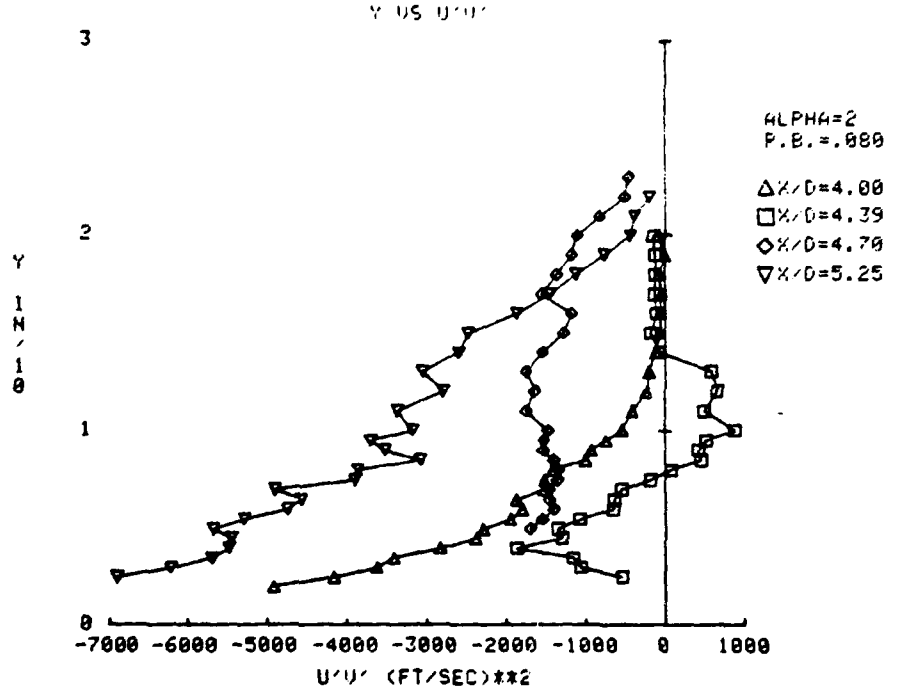

FIGURE A-29. REYNOLD'S STRESSES ($\alpha = 2^{\circ}$, LEEWARD)

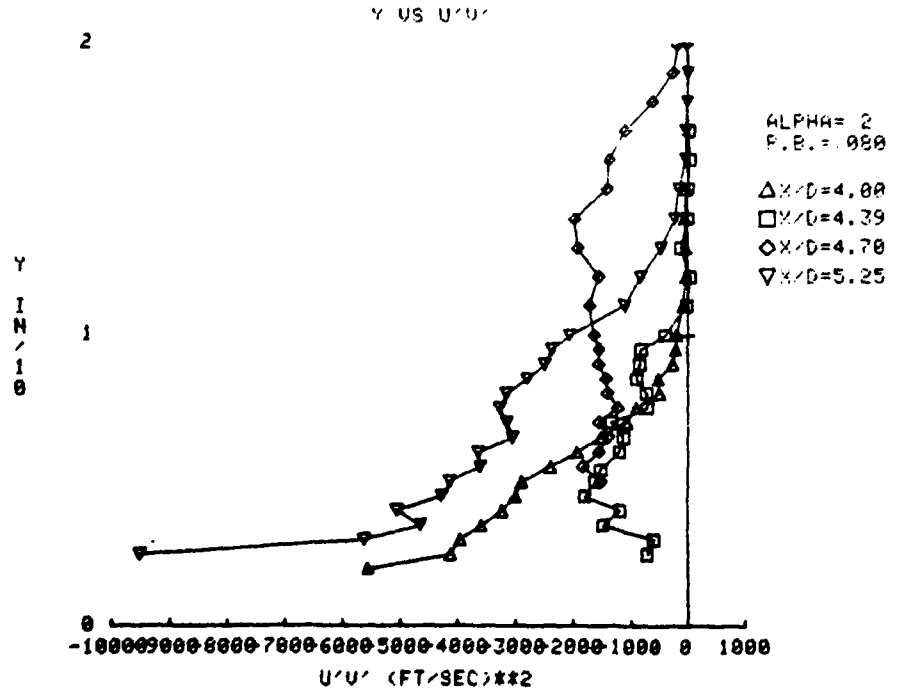

FIGURE A-30. REYNOLD'S STRESSES ($\alpha = 2^{\circ}$, WINDWARD)

APPENDIX B
SURFACE PRESSURE DATA

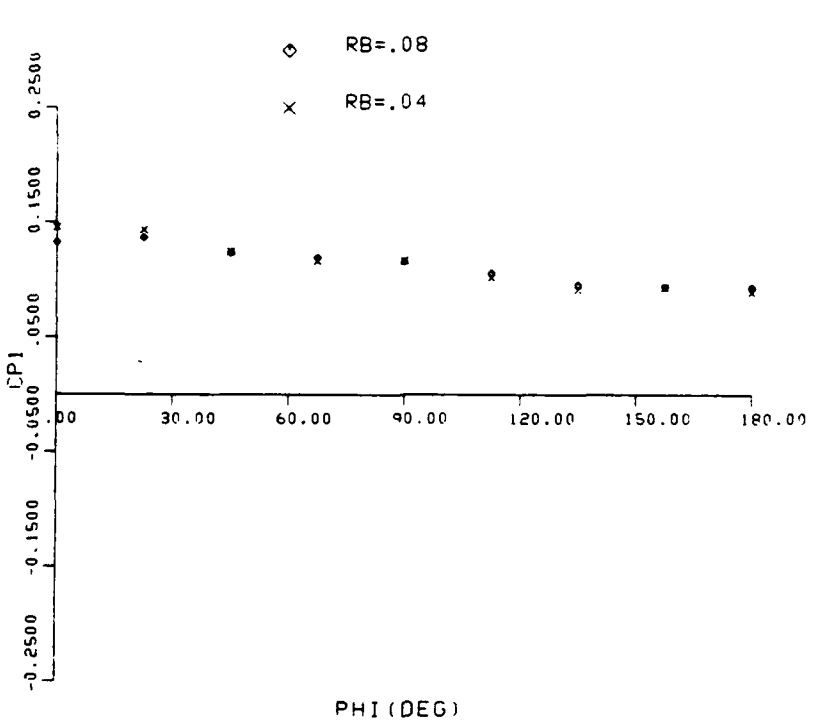

FIGURE B-1 (a). PRESSURE COEFFICIENTS vs. ROLL ANGLE

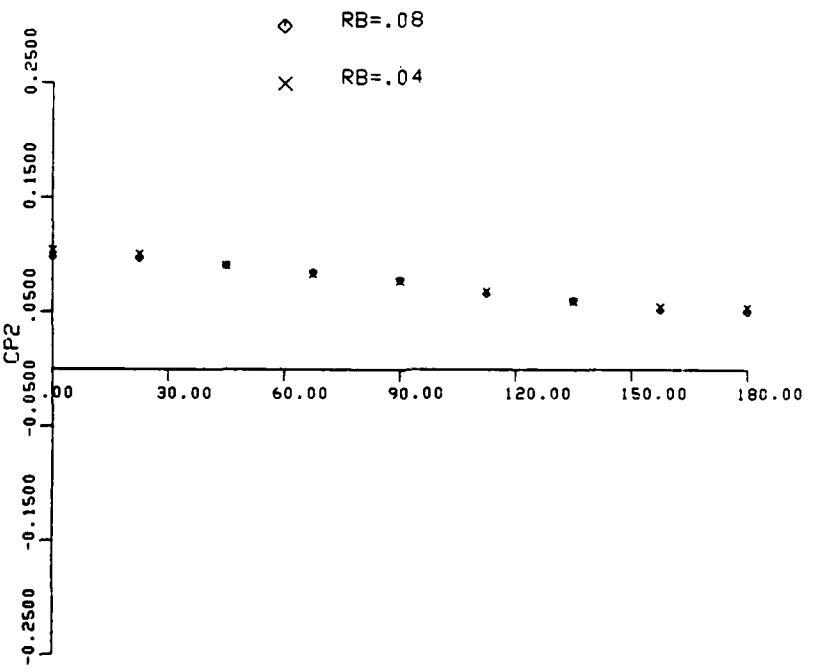

FIGURE B-1 (b). PRESSURE COEFICIENTS vs. ROLL ANGLE

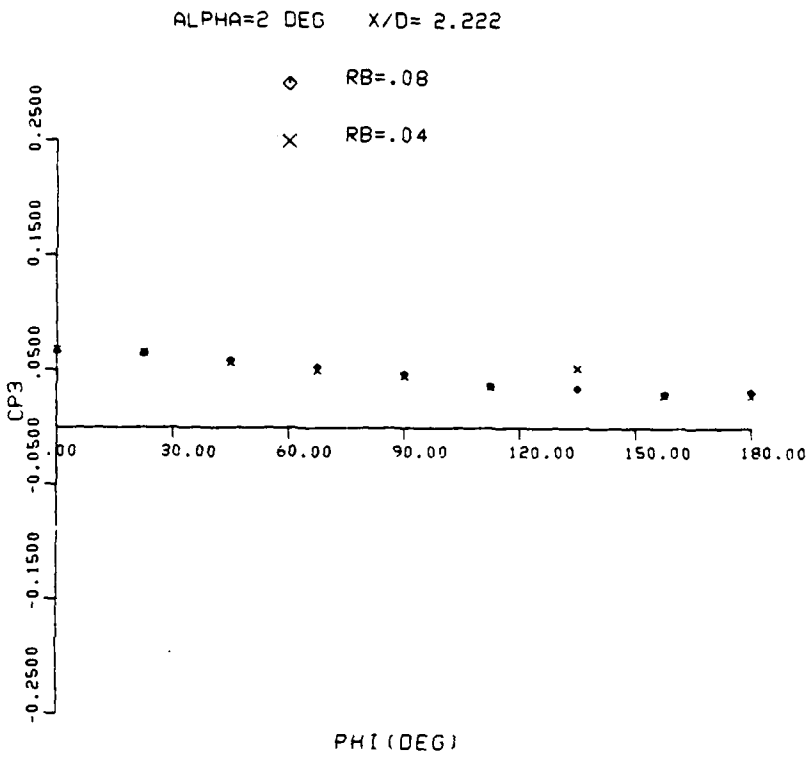

FIGURE B-1 (c). PRESSURE COEFFICIENTS vs. ROLL ANGLE

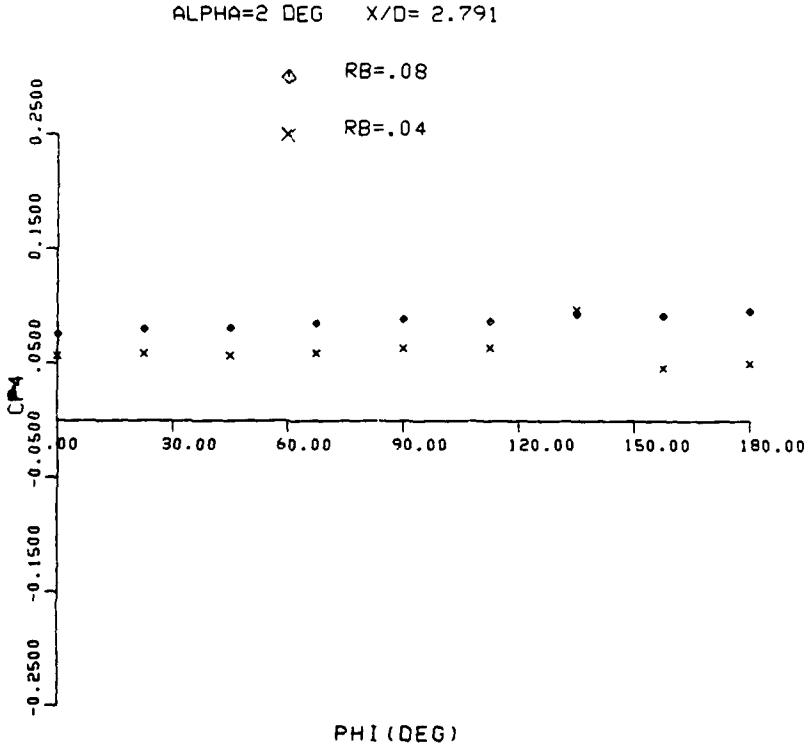

FIGURE B-1 (d). PRESSURE COEFFICIENTS vs. ROLL ANGLE

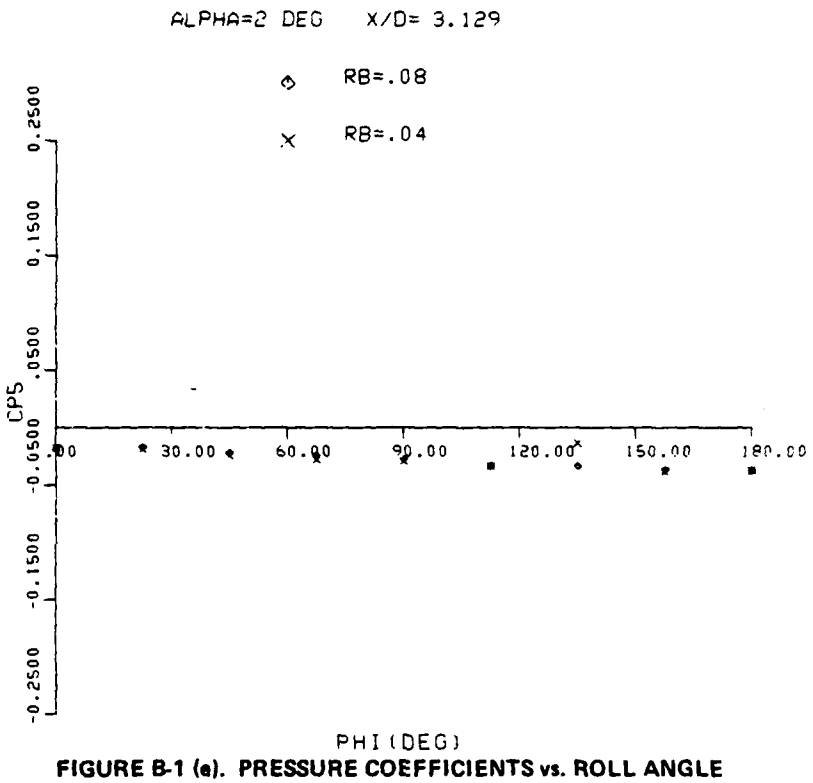

FIGURE B-1 (e). PRESSURE COEFFICIENTS vs. ROLL ANGLE

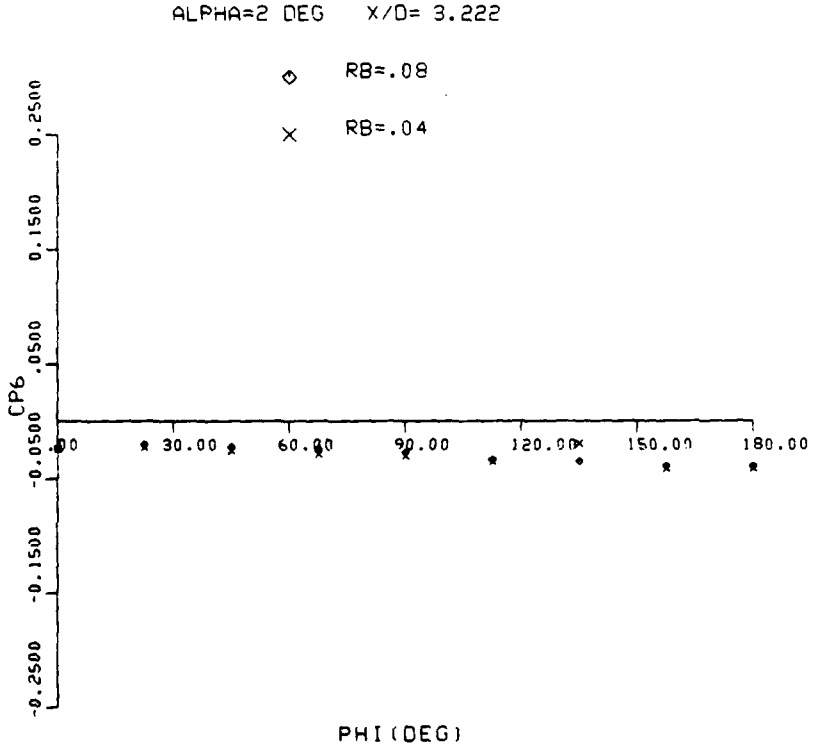

FIGURE B-1 (f). PRESSURE COEFFICIENTS vs. ROLL ANGLE

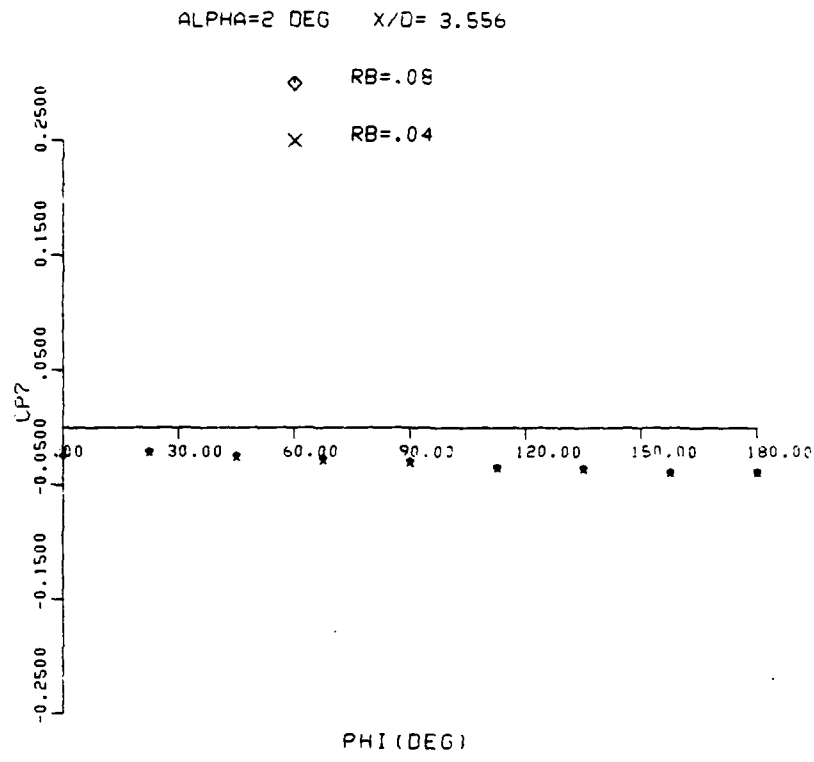

FIGURE B-1 (g). PRESSURE COEFFICIENTS vs. ROLL ANGLE

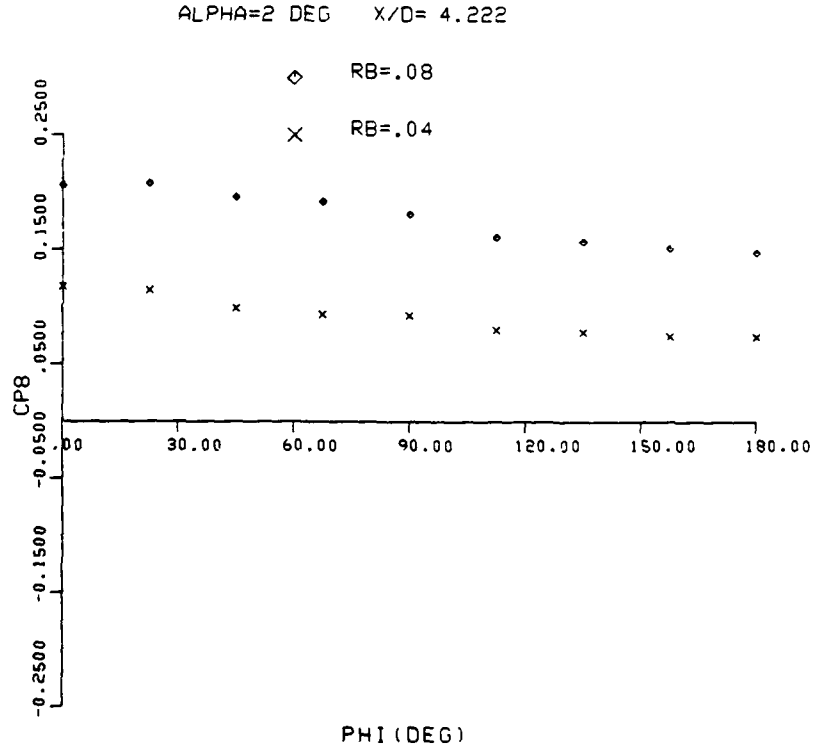

FIGURE B-1 (h). PRESSURE COEFFICIENTS vs. ROLL ANGLE

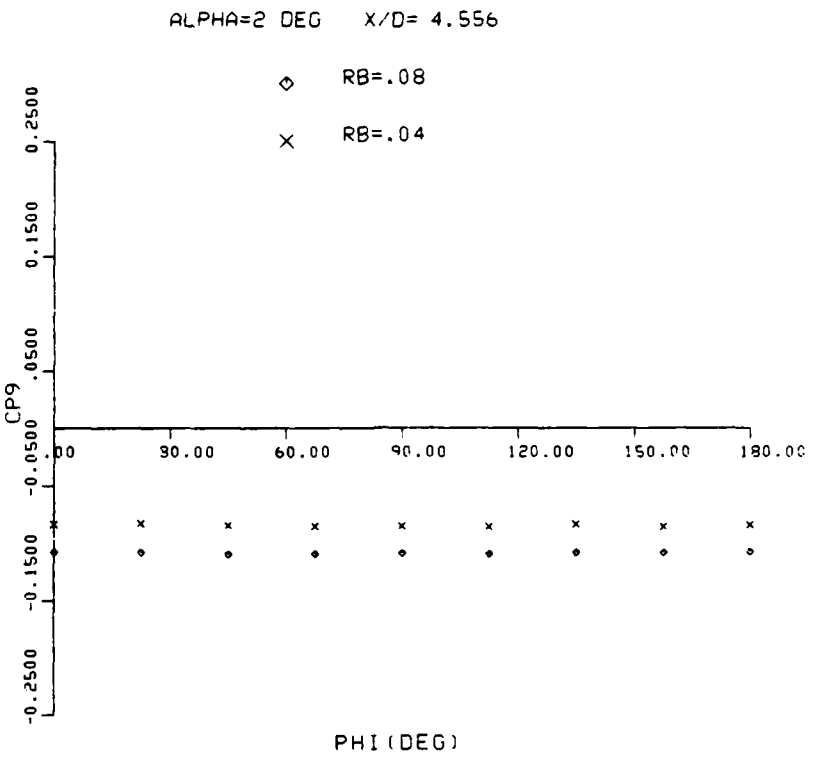

FIGURE B-1 (i). PRESSURE COEFFICIENTS vs. ROLL ANGLE

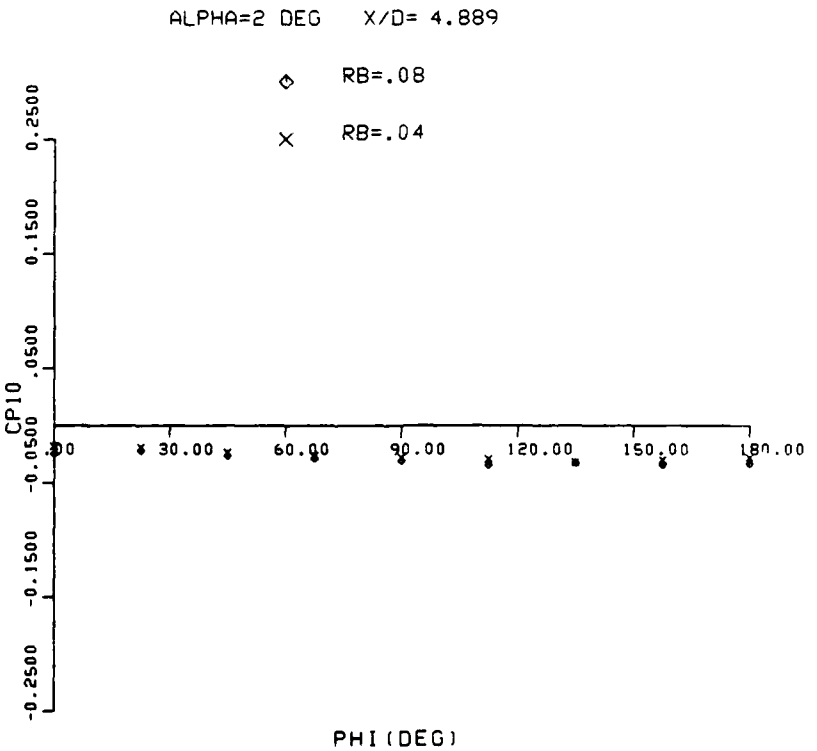

FIGURE B-1 (j). PRESSURE COEFFICIENTS vs. ROLL ANGLE

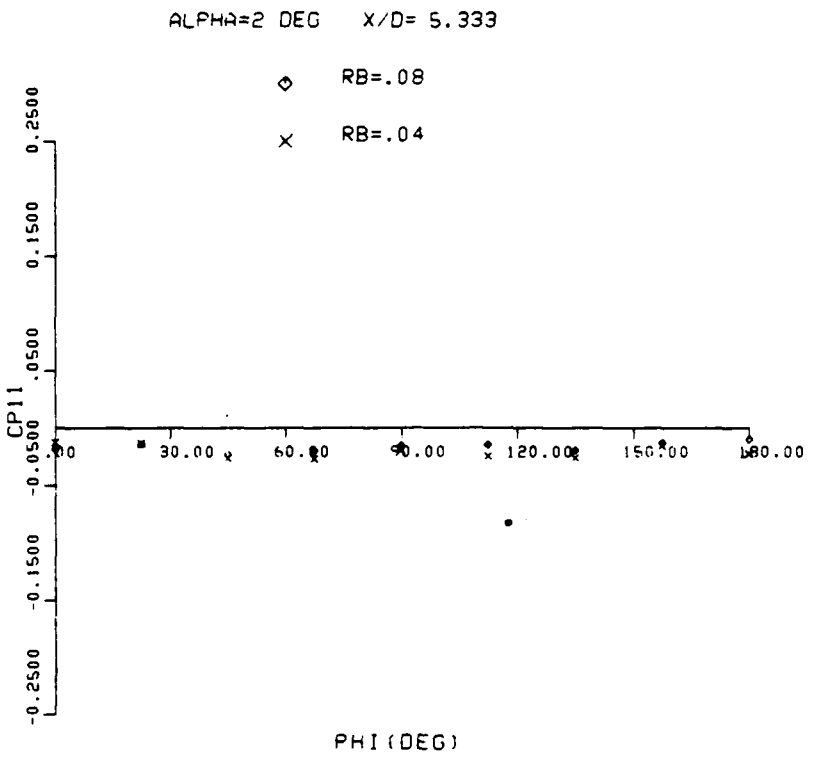

FIGURE B-1 (k). PRESSURE COEFFICIENTS vs. ROLL ANGLE

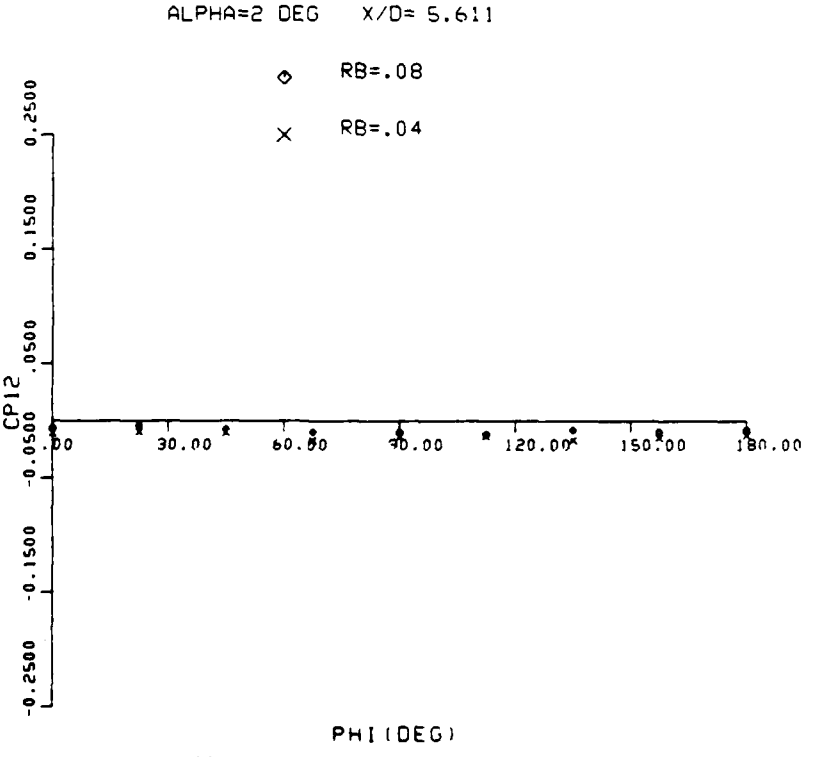

FIGURE B-1 (l). PRESSURE COEFFICIENTS vs. ROLL ANGLE

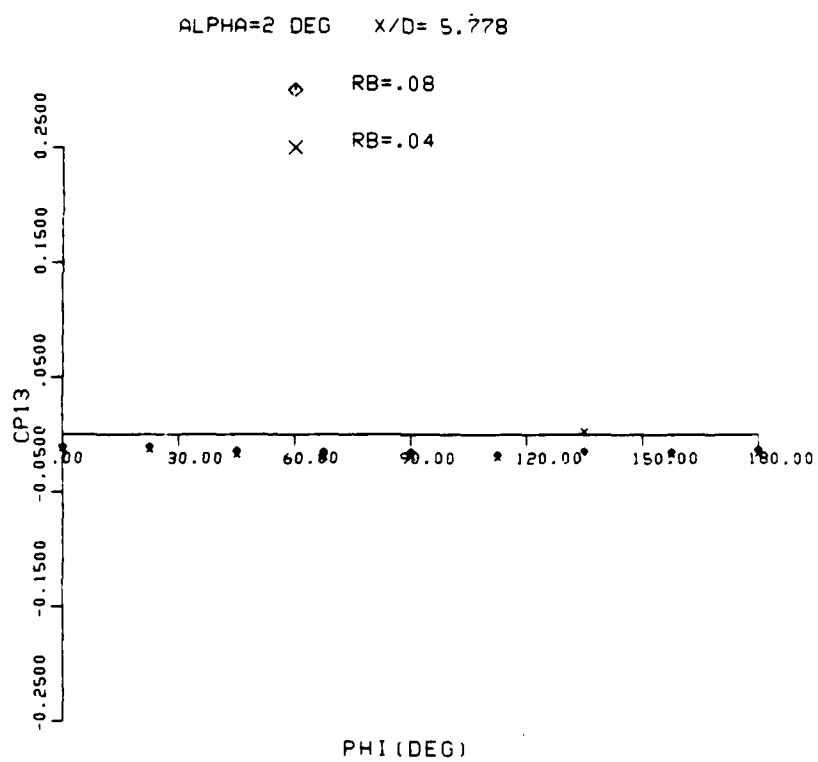

FIGURE B-1 (m). PRESSURE COEFFICIENTS vs. ROLL ANGLE

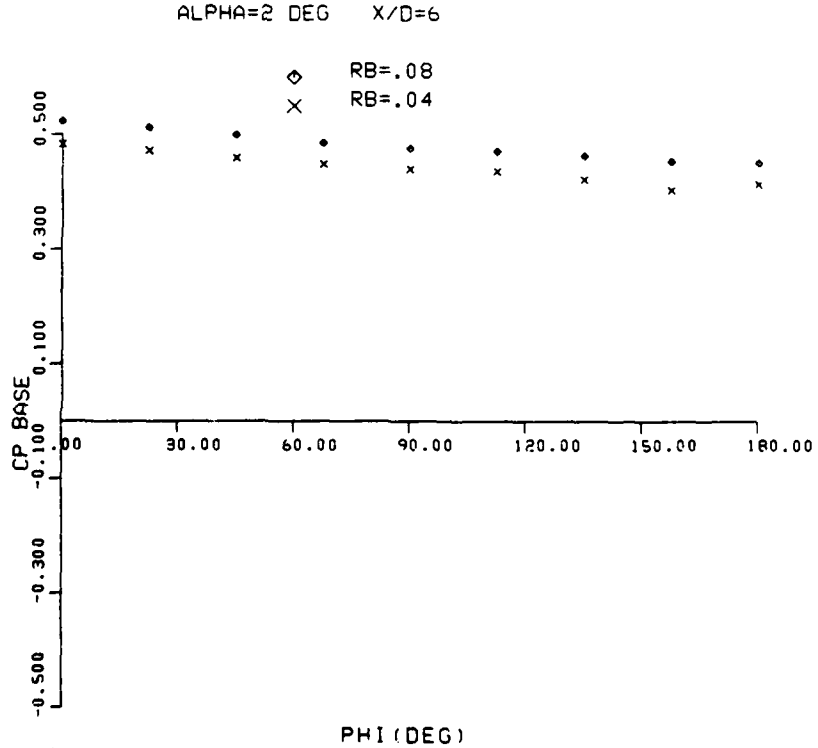

FIGURE B-1 (n). PRESSURE COEFFICIENTS vs. ROLL ANGLE

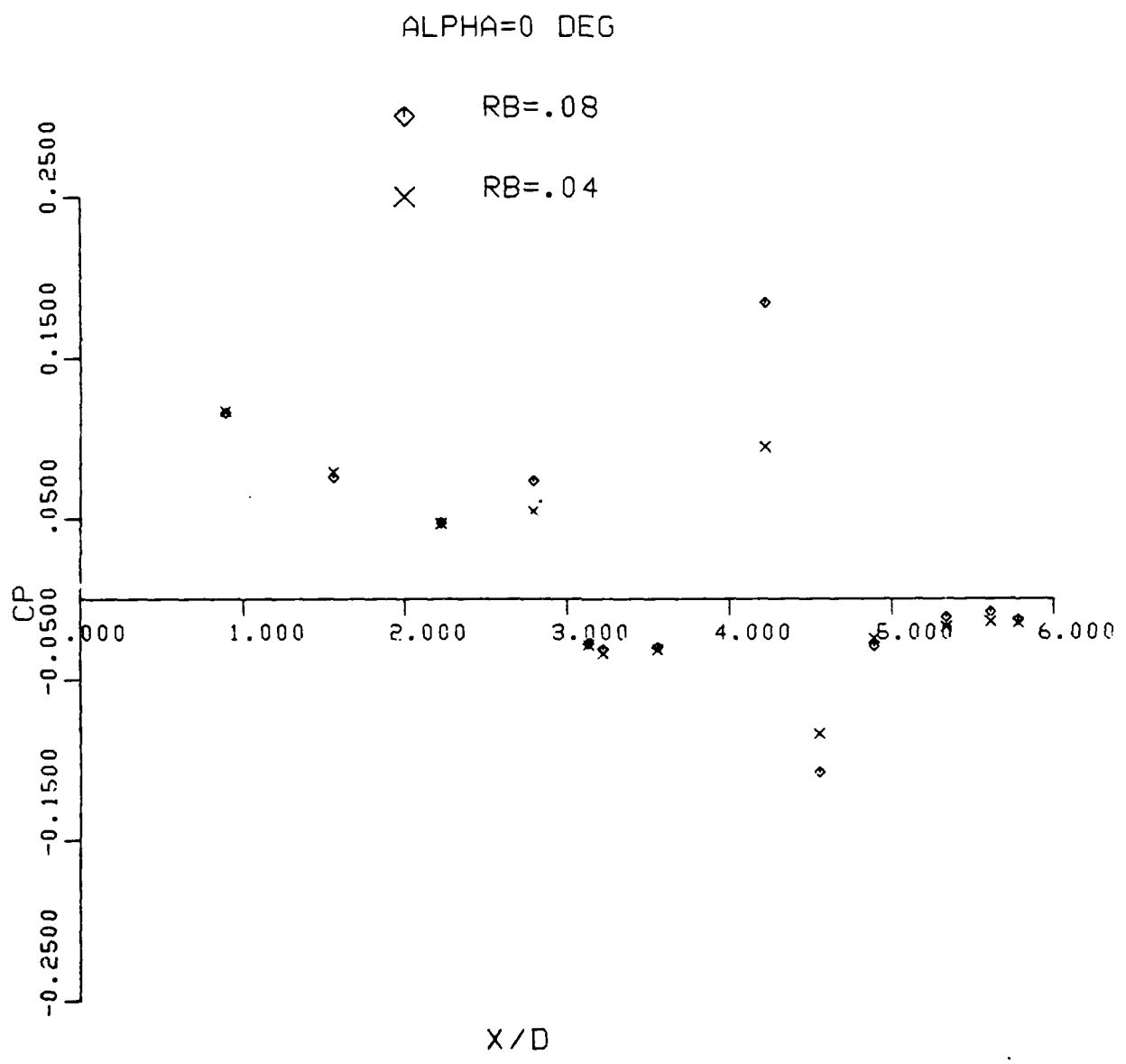

FIGURE B-2. PRESSURE COEFFICIENTS vs. X/D

TABULATED VELOCITY, TURBULENCE INTENSITY, REYNOLDS STRESS DATA

FILE NO.=2
RUN#=82051901 X/D=4 ALPHA=0 BETA=0
NO.OF POINTS= 27

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.019	135	1472.3	-19.9	2.064	-0.0279	225.6	47.0	-4183.8
0.025	136	1565.4	-18.3	2.195	-0.0256	180.4	46.5	-4347.3
0.030	136	1623.6	-18.1	2.277	-0.0254	157.4	46.0	-3481.0
0.035	136	1662.7	-17.3	2.331	-0.0243	147.4	45.5	-3132.6
0.040	136	1703.6	-12.9	2.389	-0.0180	140.3	47.3	-3113.7
0.045	137	1735.7	-11.9	2.434	-0.0167	139.2	45.5	-3091.4
0.050	137	1775.2	-12.7	2.489	-0.0178	134.7	45.5	-2799.1
0.055	137	1812.6	-10.8	2.542	-0.0152	131.3	43.9	-2443.2
0.060	137	1849.5	-10.2	2.593	-0.0144	126.9	44.5	-2156.7
0.065	137	1884.0	-10.1	2.642	-0.0141	119.4	42.3	-1832.1
0.070	137	1921.5	-9.2	2.694	-0.0128	115.2	43.9	-1716.3
0.075	137	1951.4	-8.7	2.736	-0.0122	104.8	40.3	-1354.4
0.080	138	1981.6	-8.4	2.778	-0.0118	92.5	38.6	-1062.9
0.085	138	2008.0	-7.7	2.815	-0.0108	84.2	39.3	-925.8
0.090	138	2029.2	-7.9	2.845	-0.0111	76.8	33.4	-770.3
0.095	138	2051.1	-6.0	2.876	-0.0085	68.6	34.2	-551.4
0.100	138	2069.0	-5.6	2.901	-0.0079	60.8	35.1	-476.5
0.110	138	2100.2	-3.1	2.945	-0.0044	52.5	31.7	-377.6
0.120	138	2123.8	-1.2	2.978	-0.0017	43.3	30.8	-185.1
0.130	138	2140.9	0.4	3.002	0.0006	29.7	26.8	-111.6
0.140	138	2149.1	-0.1	3.013	-0.0001	21.6	29.2	-61.5
0.150	138	2153.7	0.2	3.020	0.0002	17.0	33.2	-32.3
0.160	139	2156.7	-0.1	3.024	-0.0002	13.6	30.4	7.6
0.170	139	2157.6	0.4	3.025	0.0005	11.7	37.2	-6.2
0.180	139	2160.4	-0.1	3.029	-0.0001	9.2	32.0	-26.2
0.190	139	2160.8	1.1	3.030	0.0016	7.3	34.0	-40.2
0.200	139	2161.7	2.0	3.031	0.0029	0.0	23.9	-12.2

FILE NO.=3
RUN#=82051902 X/D=4.39 ALPHA=0 BETA=0
NO.OF POINTS= 27

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.020	139	1380.6	2.6	1.933	0.0036	193.7	56.8	-1351.9
0.025	139	1390.8	3.9	1.947	0.0055	194.8	56.9	-2594.4
0.030	140	1429.0	11.6	2.001	0.0162	201.1	58.2	-2892.5
0.035	140	1452.4	19.9	2.033	0.0278	201.6	59.2	-2890.8
0.040	140	1486.0	26.7	2.080	0.0374	202.6	57.1	-2764.7
0.045	140	1515.3	33.6	2.121	0.0470	198.8	56.1	-2702.2
0.050	140	1551.3	41.7	2.171	0.0584	200.1	56.3	-2542.6
0.055	140	1584.3	47.0	2.218	0.0658	203.0	53.4	-1907.0
0.060	140	1613.8	58.2	2.259	0.0814	198.9	50.7	-2252.7
0.065	140	1655.4	63.7	2.317	0.0892	197.6	49.3	-1834.4
0.070	140	1695.4	67.6	2.373	0.0947	191.1	48.8	-1991.7
0.075	140	1721.5	75.6	2.410	0.1058	192.2	45.4	-1976.4
0.080	140	1765.5	80.6	2.471	0.1128	184.9	42.9	-1567.6
0.085	140	1806.7	84.8	2.529	0.1187	179.3	40.3	-1563.8
0.090	140	1843.9	91.1	2.581	0.1275	178.1	39.9	-1196.8
0.095	140	1884.9	96.2	2.639	0.1347	159.8	36.5	-1325.9
0.100	140	1923.4	100.4	2.692	0.1406	148.6	35.2	-863.4
0.110	141	1995.1	109.7	2.793	0.1536	114.2	32.0	-475.8
0.120	141	2051.5	118.3	2.872	0.1656	70.4	32.9	-309.7
0.130	141	2080.5	121.1	2.912	0.1695	47.6	31.2	-257.8
0.140	141	2097.6	120.3	2.936	0.1685	38.7	36.7	-201.3
0.150	141	2110.4	113.5	2.954	0.1589	33.6	31.9	-171.8
0.160	141	2122.5	102.0	2.971	0.1428	26.1	36.7	-113.8
0.170	141	2129.3	90.4	2.981	0.1266	22.0	40.5	-69.8
0.180	141	2134.8	78.2	2.988	0.1094	19.4	36.8	-76.1
0.190	141	2142.0	62.6	2.998	0.0876	10.1	42.5	-31.2
0.200	141	2145.6	48.7	3.003	0.0681	9.8	47.2	-68.9

FILE NO.=4
RUN#=82051903 X/D=4.7 ALPHA=0 BETA=0
NO.OF POINTS= 26

Y	T0	U	V	U/A	V/A	USD	USD	U'V'
0.025	141	1482.8	-96.0	2.072	-0.1341	137.6	50.8	-3782.9
0.030	141	1523.3	-92.7	2.129	-0.1296	129.3	51.4	-3667.5
0.035	141	1552.9	-89.0	2.170	-0.1244	120.2	49.9	-2894.8
0.040	141	1589.2	-90.1	2.221	-0.1259	115.9	49.0	-2598.2
0.045	142	1616.0	-90.0	2.258	-0.1258	112.5	49.7	-2426.6
0.050	142	1636.3	-90.5	2.287	-0.1265	106.2	49.3	-2154.4
0.055	142	1658.1	-90.0	2.317	-0.1258	105.3	48.6	-2050.3
0.060	142	1680.2	-91.7	2.348	-0.1282	106.1	47.3	-1852.6
0.065	142	1693.6	-91.4	2.367	-0.1277	104.3	45.6	-1762.7
0.070	142	1715.3	-91.6	2.397	-0.1280	107.0	45.5	-1766.4
0.075	142	1733.1	-92.6	2.422	-0.1294	107.1	44.9	-1752.7
0.080	142	1760.6	-95.2	2.460	-0.1331	112.3	42.7	-1809.7
0.085	142	1777.4	-95.4	2.484	-0.1333	111.6	43.5	-1736.9
0.090	142	1794.8	-70.7	2.508	-0.0988	116.5	1224.5	-1339.4
0.095	142	1821.1	-99.3	2.545	-0.1388	113.5	40.9	-1644.1
0.100	142	1842.4	-99.5	2.575	-0.1391	118.4	40.0	-1643.7
0.110	142	1886.2	-101.2	2.636	-0.1415	120.7	41.2	-1811.4
0.120	142	1932.4	-98.4	2.700	-0.1375	118.4	40.6	-1408.8
0.130	142	1974.7	-90.7	2.760	-0.1268	110.1	39.2	-855.9
0.140	142	2021.9	-77.8	2.826	-0.1088	90.8	35.3	-491.5
0.150	142	2059.5	-64.9	2.878	-0.0906	76.7	35.8	-269.7
0.160	142	2084.4	-54.1	2.913	-0.0756	64.5	31.5	-265.9
0.170	142	2107.3	-40.2	2.945	-0.0562	54.2	34.4	-152.0
0.180	142	2123.0	-27.7	2.967	-0.0387	41.9	29.1	-101.8
0.190	142	2135.6	-11.3	2.984	-0.0157	32.4	42.7	-2.0
0.200	143	2140.0	0.8	2.991	0.0012	26.0	34.2	-10.5

FILE NO.=5
RUN#=82051904 X/D=5.25 ALPHA=0 BETA=0
NO.OF POINTS= 27

Y	T0	U	U	U/A	U/A	USD	USD	U'U'
0.020	143	1279.8	-18.7	1.786	-0.0260	257.1	58.7	-8069.4
0.025	143	1412.3	-23.9	1.970	-0.0334	199.4	55.7	-6392.3
0.030	143	1466.4	-24.8	2.046	-0.0346	181.0	57.8	-5441.0
0.035	143	1508.3	-24.4	2.104	-0.0340	170.1	56.8	-5244.9
0.040	143	1541.7	-23.7	2.151	-0.0331	157.6	57.2	-4580.0
0.045	143	1576.2	-21.7	2.199	-0.0303	151.7	58.4	-4708.5
0.050	143	1603.1	-19.8	2.237	-0.0276	154.4	58.0	-4610.1
0.055	143	1630.6	-19.5	2.275	-0.0272	144.3	56.7	-3880.4
0.060	143	1659.9	-19.1	2.316	-0.0266	136.4	57.2	-3567.0
0.065	143	1688.7	-20.7	2.356	-0.0289	134.6	56.5	-3450.5
0.070	143	1711.4	-17.6	2.388	-0.0246	142.6	56.1	-3551.4
0.075	144	1734.0	-16.4	2.419	-0.0229	137.9	56.9	-3358.6
0.080	144	1767.1	-18.3	2.465	-0.0255	139.4	55.1	-3345.2
0.085	144	1788.2	-15.5	2.495	-0.0216	138.6	54.7	-3302.2
0.090	144	1821.4	-19.1	2.541	-0.0266	135.8	54.1	-3076.2
0.095	144	1848.2	-18.3	2.579	-0.0256	135.1	53.9	-3178.7
0.100	144	1875.1	-17.7	2.616	-0.0247	132.1	52.5	-2731.3
0.110	144	1936.8	-18.3	2.702	-0.0255	124.0	50.0	-2278.4
0.120	144	1993.1	-19.0	2.781	-0.0265	101.5	49.0	-1695.4
0.130	144	2042.2	-19.8	2.849	-0.0276	81.0	43.5	-1084.7
0.140	144	2080.2	-19.4	2.902	-0.0270	60.6	37.7	-430.4
0.150	144	2108.1	-17.7	2.941	-0.0246	47.4	37.8	-217.0
0.160	144	2127.8	-17.3	2.969	-0.0242	36.3	38.0	-153.3
0.170	144	2141.6	-17.6	2.988	-0.0245	27.8	34.1	-127.9
0.180	144	2148.9	-18.9	2.998	-0.0263	20.6	30.2	-28.0
0.190	144	2155.2	-19.2	3.007	-0.0268	12.6	43.3	-19.1
0.200	144	2159.0	-23.5	3.012	-0.0328	9.2	28.2	-21.9

FILE NO.=6
RUN#=82051905 X/D=4 ALPHA=2 BETA=0
NO.OF POINTS= 27

Y	T0	U	U	U/A	U/A	USD	USD	U'U'
0.020	144	1406.4	-14.8	1.962	-0.0207	226.7	46.4	-4920.7
0.025	144	1508.0	-13.0	2.104	-0.0182	184.8	43.8	-4156.7
0.030	144	1562.6	-10.2	2.180	-0.0143	164.1	45.6	-3621.4
0.035	144	1602.3	-6.1	2.235	-0.0085	150.2	46.4	-3407.5
0.040	144	1641.0	-3.5	2.290	-0.0048	137.0	44.7	-2826.5
0.045	144	1679.3	-2.2	2.343	-0.0031	130.9	44.9	-2372.1
0.050	144	1708.0	-0.1	2.383	-0.0001	128.1	45.0	-2287.1
0.055	144	1750.3	2.0	2.442	0.0028	120.5	44.6	-1944.5
0.060	144	1780.6	3.1	2.484	0.0043	120.6	43.4	-1796.1
0.065	144	1811.5	3.8	2.527	0.0053	119.6	43.5	-1871.9
0.070	144	1844.2	4.2	2.573	0.0059	117.4	41.5	-1522.2
0.075	144	1878.8	6.9	2.621	0.0097	112.9	42.9	-1516.1
0.080	144	1906.1	7.7	2.659	0.0107	107.4	40.2	-1419.1
0.085	144	1936.9	7.1	2.702	0.0098	100.0	38.2	-998.4
0.090	144	1964.3	8.3	2.741	0.0116	94.0	38.5	-928.8
0.095	144	1989.4	9.1	2.776	0.0127	83.8	38.8	-749.9
0.100	144	2008.8	9.6	2.803	0.0134	76.8	37.9	-541.6
0.110	144	2046.4	9.5	2.855	0.0132	64.8	33.9	-419.2
0.120	144	2077.1	11.2	2.898	0.0156	56.3	30.0	-236.2
0.130	144	2103.4	12.5	2.935	0.0174	49.2	28.9	-204.7
0.140	144	2125.2	13.9	2.965	0.0194	44.3	33.2	-118.3
0.150	144	2144.9	15.3	2.993	0.0214	38.3	33.8	-67.7
0.160	144	2159.0	16.0	3.012	0.0223	35.0	28.3	-61.7
0.170	144	2169.5	16.2	3.027	0.0226	31.9	26.3	-48.2
0.180	144	2174.3	16.1	3.033	0.0225	30.9	33.8	-72.8
0.190	144	2178.8	16.3	3.040	0.0228	28.4	22.4	-4.1
0.200	144	2179.5	17.9	3.041	0.0249	28.2	37.2	-83.4

FILE NO.=7
RUN#=82051906 X/D=4.39 ALPHA=2 BETA=0
NO.OF POINTS= 26

Y	T0	U	U	U/A	U/A	USD	USD	U/U
0.025	145	1274.2	3.8	1.776	0.0054	281.1	52.7	-2552.8
0.030	145	1392.9	8.3	1.942	0.0115	181.7	53.4	-2235.3
0.035	145	1416.0	13.7	1.974	0.0191	182.1	53.9	-2377.9
0.040	145	1450.6	21.0	2.022	0.0292	187.1	53.5	-2425.2
0.045	145	1488.9	27.1	2.076	0.0377	186.2	54.3	-2762.8
0.050	145	1519.8	33.2	2.119	0.0462	185.1	54.5	-2566.2
0.055	145	1559.3	38.1	2.174	0.0531	181.5	52.8	-2189.0
0.060	145	1589.9	42.6	2.216	0.0594	173.1	51.5	-1990.4
0.065	145	1621.9	48.8	2.261	0.0681	171.5	50.7	-2032.4
0.070	145	1654.5	53.3	2.306	0.0743	173.0	49.9	-1712.1
0.075	145	1686.9	57.9	2.352	0.0807	169.6	49.0	-1568.9
0.080	145	1714.5	63.4	2.390	0.0884	167.5	49.1	-1746.9
0.085	145	1740.4	67.4	2.426	0.0940	162.5	48.0	-1486.9
0.090	145	1767.6	74.9	2.464	0.1045	163.5	47.9	-1803.0
0.095	145	1798.5	78.4	2.507	0.1093	161.4	46.6	-1655.9
0.100	145	1836.5	84.8	2.560	0.1182	152.7	45.9	-1640.6
0.110	145	1888.5	92.6	2.633	0.1291	143.4	45.4	-1371.5
0.120	145	1955.6	102.0	2.726	0.1422	124.8	44.4	-907.4
0.130	145	2003.7	112.8	2.793	0.1572	99.6	41.3	-730.4
0.140	145	2048.4	122.1	2.856	0.1702	72.3	39.8	-487.4
0.150	145	2078.6	132.2	2.898	0.184_	52.6	37.6	-378.2
0.160	145	2100.6	137.0	2.928	0.1909	41.9	37.2	-256.9
0.170	145	2117.9	137.4	2.952	0.1916	32.3	38.1	-232.1
0.180	145	2128.3	134.6	2.967	0.1877	27.3	38.4	-189.4
0.190	145	2136.0	126.8	2.978	0.1768	26.1	39.8	-159.8
0.200	145	2142.8	115.3	2.987	0.1608	26.8	38.6	-118.5

FILE NO.=8
RUN#=82051907 X/D=4.7 ALPHA=2 BETA=0
NO.OF POINTS= 25

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.030	145	1430.4	-74.6	1.994	-0.1040	152.3	56.9	-5155.7
0.035	145	1463.4	-73.6	2.040	-0.1026	148.2	56.9	-4757.6
0.040	145	1500.5	-71.5	2.092	-0.0997	136.6	52.7	-3903.0
0.045	145	1529.8	-70.4	2.133	-0.0981	126.0	52.7	-3088.9
0.050	145	1559.0	-70.6	2.173	-0.0984	123.3	51.7	-2962.7
0.055	145	1586.4	-69.3	2.211	-0.0967	117.3	50.7	-2619.2
0.060	145	1618.3	-76.0	2.256	-0.1060	107.1	51.6	-2270.5
0.065	145	1637.4	-75.5	2.283	-0.1053	104.3	50.5	-2089.5
0.070	145	1660.5	-77.3	2.315	-0.1078	108.3	50.8	-2158.2
0.075	145	1675.4	-78.7	2.335	-0.1097	105.6	49.8	-1967.5
0.080	145	1696.7	-77.8	2.365	-0.1084	105.2	49.0	-1893.5
0.085	145	1717.0	-79.0	2.394	-0.1101	106.0	49.7	-1905.9
0.090	145	1735.0	-79.7	2.419	-0.1111	104.7	46.6	-1845.2
0.095	145	1751.4	-81.1	2.441	-0.1131	107.2	46.5	-1614.2
0.100	145	1772.9	-82.7	2.471	-0.1152	110.5	44.1	-1676.4
0.110	145	1809.0	-85.2	2.522	-0.1188	111.2	42.6	-1674.6
0.120	145	1856.9	-87.7	2.589	-0.1223	112.7	42.5	-1653.9
0.130	145	1890.5	-87.7	2.635	-0.1223	115.1	44.1	-1468.4
0.140	145	1936.4	-85.2	2.699	-0.1188	105.5	43.0	-943.0
0.150	145	1971.3	-75.7	2.748	-0.1056	99.0	40.2	-812.8
0.160	145	2003.1	-59.0	2.792	-0.0822	93.5	39.3	-593.5
0.170	145	2031.5	-45.0	2.832	-0.0627	80.3	35.7	-342.0
0.180	145	2058.9	-30.8	2.870	-0.0429	68.8	36.1	-301.8
0.190	145	2082.5	-16.9	2.903	-0.0236	60.0	34.8	-206.4
0.200	145	2097.8	-5.3	2.924	-0.0073	56.2	30.3	-168.1

FILE NO.=9
RUN#=92051908 X/D=5.25 ALPHA=2 BETA=0
NO.OF POINTS= 26

Y	T8	U	V	U/A	V/A	USD	USD	U'V'
0.025	145	1331.7	-22.5	1.856	-0.0314	181.3	51.7	-5046.1
0.030	145	1377.7	-22.3	1.921	-0.0311	165.8	54.2	-4540.2
0.035	145	1412.6	-19.5	1.970	-0.0271	156.1	56.8	-4396.9
0.040	145	1441.4	-17.3	2.009	-0.0241	155.0	58.2	-4552.3
0.045	145	1473.2	-14.0	2.054	-0.0195	150.0	56.3	-4297.5
0.050	145	1504.8	-14.4	2.098	-0.0201	145.5	55.1	-3915.0
0.055	145	1535.9	-12.8	2.141	-0.0179	141.9	57.5	-3723.8
0.060	145	1562.6	-13.4	2.178	-0.0187	137.2	55.2	-3396.8
0.065	145	1585.5	-9.5	2.210	-0.0133	135.1	54.6	-3396.8
0.070	145	1609.0	-7.7	2.243	-0.0108	130.1	56.0	-3011.4
0.075	145	1637.8	-5.6	2.283	-0.0078	129.2	54.5	-3165.8
0.080	145	1657.8	-3.6	2.311	-0.0050	127.5	55.7	-2818.2
0.085	145	1678.4	-4.3	2.340	-0.0059	124.1	54.5	-2593.3
0.090	145	1697.9	0.6	2.367	0.0008	124.9	55.5	-2723.4
0.095	145	1720.9	-1.6	2.399	-0.0023	118.1	53.3	-2291.1
0.100	145	1740.4	0.5	2.426	0.0007	125.2	52.3	-2474.6
0.110	145	1785.8	3.6	2.489	0.0050	119.3	51.5	-2173.1
0.120	145	1829.6	3.3	2.550	0.0046	118.6	52.4	-1991.2
0.130	145	1879.3	5.2	2.620	0.0072	118.1	47.6	-1938.1
0.140	145	1929.2	5.5	2.689	0.0077	109.8	45.5	-1336.0
0.150	145	1973.5	7.1	2.751	0.0098	94.5	47.4	-1094.4
0.160	145	2012.5	8.1	2.805	0.0113	82.5	43.3	-943.0
0.170	145	2046.0	5.8	2.852	0.0081	64.6	37.0	-424.9
0.180	145	2075.5	7.0	2.893	0.0097	55.1	37.7	-335.6
0.190	145	2097.3	5.9	2.924	0.0083	48.6	32.4	-283.7
0.200	145	2118.0	8.0	2.953	0.0111	43.1	35.2	-207.1

FILE NO.=10
RUN#=82051909 X/D=4 ALPHA=-2 BETA=0
NO.OF POINTS= 22

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.020	145	1528.6	-25.3	2.131	-0.0352	230.9	48.7	-5552.9
0.025	145	1637.9	-28.1	2.283	-0.0392	175.6	48.8	-4118.4
0.030	145	1691.4	-26.2	2.358	-0.0365	169.3	49.5	-3961.3
0.035	145	1742.1	-23.2	2.429	-0.0323	157.4	49.4	-3586.7
0.040	145	1789.8	-22.4	2.495	-0.0312	148.3	47.7	-3229.1
0.045	145	1824.6	-21.6	2.544	-0.0301	144.3	46.5	-2998.8
0.050	145	1867.8	-19.3	2.603	-0.0269	143.8	46.4	-2897.0
0.055	145	1912.6	-20.4	2.666	-0.0285	133.7	42.1	-2391.8
0.060	145	1957.6	-19.9	2.729	-0.0277	118.4	39.9	-1934.3
0.065	145	1987.3	-18.7	2.770	-0.0261	111.0	41.2	-1518.4
0.070	145	2023.7	-17.2	2.821	-0.0240	93.6	38.2	-1073.2
0.075	145	2051.3	-16.4	2.860	-0.0228	80.5	34.0	-903.7
0.080	145	2074.8	-15.1	2.892	-0.0211	68.5	33.8	-496.4
0.085	145	2093.6	-13.8	2.918	-0.0193	63.6	33.3	-507.7
0.090	145	2113.7	-14.4	2.946	-0.0201	53.4	29.8	-254.4
0.095	14	2126.6	-12.0	2.965	-0.0167	47.5	30.4	-202.7
0.100	145	2137.9	-11.4	2.980	-0.0159	40.4	29.3	-194.0
0.110	145	2151.4	-11.3	2.999	-0.0158	31.3	25.2	-78.6
0.120	145	2158.5	-11.6	3.009	-0.0162	28.5	25.3	-33.7
0.130	145	2162.1	-11.9	3.014	-0.0165	25.0	23.8	-30.3
0.140	145	2163.8	-13.3	3.016	-0.0185	24.7	19.1	-47.1
0.150	145	2165.1	-12.2	3.018	-0.0170	22.7	29.5	-23.4

FILE NO.=11
RUN#=82051910 X/D=4.39 ALPHA=-2 BETA=0
NO.OF POINTS= 21

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.025	145	1473.2	-3.9	2.054	-0.0054	176.0	58.1	-2161.3
0.030	145	1533.8	0.2	2.138	0.0003	184.8	59.4	-2679.8
0.035	145	1555.2	8.6	2.168	0.0120	183.2	56.6	-2514.6
0.040	145	1579.8	15.6	2.202	0.0218	183.6	55.4	-2573.8
0.045	145	1610.0	21.8	2.244	0.0304	189.5	53.1	-2416.0
0.050	145	1645.8	27.6	2.294	0.0385	189.3	49.8	-2448.3
0.055	145	1681.2	34.6	2.344	0.0482	184.8	46.9	-2120.5
0.060	145	1721.6	43.2	2.400	0.0602	192.5	42.8	-2119.7
0.065	145	1779.4	49.1	2.481	0.0685	187.7	38.8	-1827.1
0.070	145	1814.9	54.0	2.530	0.0752	188.7	36.0	-1858.0
0.075	145	1864.2	57.2	2.599	0.0798	178.2	35.1	-1564.2
0.080	145	1910.1	60.3	2.663	0.0840	165.7	32.9	-1211.6
0.085	145	1950.6	63.5	2.719	0.0886	157.2	27.8	-1260.8
0.090	145	1989.6	67.1	2.774	0.0935	132.7	28.0	-1010.6
0.095	145	2028.1	69.5	2.827	0.0969	105.3	24.6	-576.4
0.100	145	2058.8	71.9	2.870	0.1002	78.0	27.4	-403.9
0.110	145	2091.4	74.4	2.915	0.1038	51.9	25.6	-243.7
0.120	145	2111.5	75.5	2.943	0.1053	34.2	25.1	-144.8
0.130	145	2121.7	72.2	2.958	0.1006	29.0	24.8	-49.0
0.140	145	2126.8	68.6	2.965	0.0956	24.7	29.9	-41.8
0.150	145	2128.2	63.2	2.967	0.0880	23.3	31.7	12.0

FILE NO.=12
RUN#=82051911 X/D=4.7 ALPHA=-2 BETA=0
NO.OF POINTS= 21

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.025	145	1559.8	-95.7	2.174	-0.1334	152.2	57.9	-5049.5
0.030	145	1614.4	-94.7	2.250	-0.1320	129.6	54.6	-3700.0
0.035	145	1645.3	-93.7	2.294	-0.1306	120.7	53.5	-3201.2
0.040	145	1679.2	-92.8	2.341	-0.1293	117.8	54.1	-2958.8
0.045	145	1706.4	-91.1	2.379	-0.1270	109.9	51.8	-2607.6
0.050	145	1726.0	-93.3	2.406	-0.1300	104.5	49.2	-2113.4
0.055	145	1750.6	-93.5	2.440	-0.1303	108.3	49.1	-2228.0
0.060	145	1772.8	-95.6	2.471	-0.1333	107.9	47.7	-2107.9
0.065	145	1799.4	-97.1	2.509	-0.1354	110.1	46.2	-1883.2
0.070	145	1822.7	-98.0	2.541	-0.1366	116.2	46.6	-2033.4
0.075	145	1846.5	-101.2	2.574	-0.1411	116.7	42.9	-1947.0
0.080	145	1878.9	-103.2	2.619	-0.1439	116.8	43.0	-1719.1
0.085	145	1906.7	-105.7	2.658	-0.1473	119.5	39.8	-1804.8
0.090	145	1927.7	-106.7	2.687	-0.1488	117.9	41.0	-1653.3
0.095	145	1960.8	-111.7	2.733	-0.1557	113.6	41.8	-1666.7
0.100	145	1987.4	-113.1	2.771	-0.1577	107.1	37.7	-1419.7
0.110	145	2033.0	-118.0	2.834	-0.1644	94.2	39.5	-1074.8
0.120	145	2068.7	-118.0	2.884	-0.1645	78.4	42.2	-706.4
0.130	145	2097.6	-116.5	2.924	-0.1624	65.5	39.5	-544.3
0.140	145	2118.3	-106.1	2.953	-0.1479	54.2	39.3	-270.1
0.150	145	2133.4	-91.9	2.974	-0.1281	45.9	37.1	-188.1

FILE NO.=13
RUN#=82051912 X/D=5.25 ALPHA=-2 BETA=0
NO.OF POINTS= 21

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.025	145	1444.3	-24.0	2.013	-0.0335	254.3	61.5	-8699.9
0.030	145	1549.3	-33.8	2.160	-0.0471	194.5	58.4	-6751.4
0.035	145	1580.5	-28.9	2.203	-0.0403	190.9	59.3	-6816.5
0.040	145	1628.6	-31.1	2.270	-0.0434	175.4	60.0	-5710.7
0.045	145	1662.1	-31.4	2.317	-0.0438	158.5	58.9	-4571.0
0.050	145	1698.0	-27.5	2.367	-0.0383	160.3	58.6	-5333.3
0.055	145	1732.1	-27.2	2.415	-0.0380	156.3	58.1	-4782.1
0.060	145	1778.5	-30.1	2.479	-0.0420	155.9	58.1	-5005.2
0.065	145	1815.6	-31.4	2.531	-0.0438	154.8	57.0	-5232.9
0.070	145	1845.9	-28.9	2.573	-0.0403	150.0	55.4	-4635.2
0.075	145	1883.3	-31.0	2.625	-0.0432	145.0	52.5	-4118.9
0.080	145	1931.9	-34.8	2.693	-0.0485	133.5	50.8	-3408.5
0.085	145	1948.8	-34.8	2.717	-0.0485	131.5	49.5	-2660.3
0.090	145	1983.4	-35.0	2.765	-0.0488	121.4	47.0	-2238.9
0.095	145	2010.9	-35.9	2.803	-0.0500	108.1	43.0	-1695.7
0.100	145	2038.9	-34.3	2.842	-0.0477	97.2	43.6	-1449.0
0.110	145	2085.5	-34.4	2.907	-0.0480	61.0	36.9	-534.2
0.120	145	2109.8	-30.1	2.941	-0.0420	50.8	39.4	-347.7
0.130	145	2130.5	-30.7	2.970	-0.0428	39.0	33.9	-295.9
0.140	145	2142.2	-30.7	2.986	-0.0427	32.0	31.3	-115.8
0.150	145	2150.3	-32.1	2.998	-0.0447	28.0	31.6	-6.6

FILE NO.=14
RUN#=92051913 X/D=4.39 ALPHA=0 BETA=0
NO.OF POINTS= 26

Y	TE	U	V	U/A	V/A	USD	VSD	U'V'
0.025	139	1388.5	24.8	1.942	0.0347	173.7	55.8	-641.6
0.030	140	1387.8	18.7	1.941	0.0262	181.5	61.8	-481.3
0.035	140	1410.4	22.9	1.973	0.0320	178.6	60.0	-1482.9
0.040	140	1438.2	33.4	2.012	0.0467	191.1	61.8	-1412.8
0.045	140	1458.7	41.8	2.040	0.0585	184.3	62.0	-1296.3
0.050	140	1483.9	53.5	2.076	0.0749	197.7	59.5	-1203.7
0.055	140	1509.2	59.1	2.111	0.0827	202.9	58.9	-1098.2
0.060	140	1543.3	67.7	2.159	0.0947	200.3	56.7	-705.3
0.065	140	1573.8	74.6	2.201	0.1044	203.2	54.6	-679.9
0.070	140	1607.0	83.3	2.248	0.1165	199.0	53.6	-984.4
0.075	140	1641.1	93.1	2.295	0.1302	204.7	49.2	-751.5
0.080	141	1675.8	101.3	2.344	0.1416	201.7	46.6	-549.9
0.085	141	1712.1	108.5	2.395	0.1518	197.5	43.7	-305.4
0.090	141	1747.8	113.8	2.445	0.1592	199.5	41.3	-445.7
0.095	141	1794.3	122.1	2.510	0.1708	204.8	38.9	-34.8
0.100	141	1845.2	131.7	2.581	0.1842	193.5	35.5	-269.5
0.110	141	1930.4	145.6	2.700	0.2036	160.5	32.8	-228.0
0.120	141	1989.6	158.9	2.783	0.2222	131.4	30.8	-293.8
0.130	141	2045.1	164.7	2.860	0.2303	89.3	31.7	-184.9
0.140	141	2076.7	162.8	2.905	0.2276	61.6	35.3	-120.7
0.150	141	2100.1	158.5	2.937	0.2217	40.9	36.9	-93.3
0.160	141	2108.8	151.0	2.949	0.2112	34.7	34.5	-51.1
0.170	141	2112.8	144.9	2.955	0.2026	33.6	31.9	-28.2
0.180	141	2113.2	138.8	2.956	0.1941	33.7	38.9	-26.1
0.190	141	2118.6	133.4	2.963	0.1865	31.7	38.8	-23.2
0.200	141	2120.1	127.5	2.965	0.1783	31.1	36.9	-50.2

FILE NO.=15
RUN#=82051914 FREESTREAM ALPHA=0 BETA=0
NO.OF POINTS= 4

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.200	141	2158.9	-6.9	3.020	-0.0096	0.0	42.7	-26.1
0.200	141	2156.6	-8.6	3.016	-0.0120	16.4	21.3	10.6
0.200	141	2156.3	-9.3	3.016	-0.0130	13.7	18.5	-3.9
0.200	141	2155.6	-9.3	3.015	-0.0130	15.6	24.2	36.0

FILE NO.=16
RUN#=82052001 X/D=4.7 ALPHA=0 BETA=0
NO.OF POINTS= 26

Y	T0	U	V	U/A	V/A	USD	USD	U'V'
0.025	120	1411.8	-210.7	1.986	-0.2864	112.1	43.6	-2775.2
0.030	124	1456.3	-206.0	2.049	-0.2898	119.7	42.7	-1854.8
0.035	128	1499.2	-201.9	2.109	-0.2841	126.9	45.1	-1254.7
0.040	129	1527.1	-203.3	2.148	-0.2860	121.4	41.2	-1475.0
0.045	130	1557.9	-205.4	2.192	-0.2890	117.2	39.4	-1039.0
0.050	131	1586.4	-205.0	2.232	-0.2884	111.8	38.1	-885.5
0.055	131	1605.9	-207.4	2.259	-0.2918	106.2	38.3	-928.0
0.060	132	1624.7	-208.1	2.286	-0.2928	107.7	36.2	-811.1
0.065	132	1639.6	-209.5	2.307	-0.2948	103.8	38.7	-610.2
0.070	133	1655.6	-210.8	2.329	-0.2965	101.8	35.9	-736.9
0.075	133	1667.8	-209.7	2.346	-0.2950	102.1	42.9	-666.8
0.080	133	1679.0	-209.4	2.362	-0.2946	99.6	40.5	-543.9
0.085	133	1688.2	-209.8	2.375	-0.2952	98.3	39.1	-463.8
0.090	134	1700.9	-207.2	2.393	-0.2915	98.1	40.5	-472.9
0.095	134	1704.2	-202.6	2.398	-0.2850	100.6	42.2	-517.9
0.100	134	1712.2	-200.1	2.409	-0.2815	104.5	43.8	-557.2
0.110	134	1735.9	-188.5	2.442	-0.2652	108.5	50.6	-504.7
0.120	135	1753.8	-176.5	2.467	-0.2483	111.1	50.4	-668.6
0.130	135	1776.4	-161.6	2.499	-0.2274	119.8	53.5	-564.6
0.140	135	1798.7	-147.0	2.531	-0.2068	127.5	54.6	-709.0
0.150	135	1836.9	-131.9	2.584	-0.1855	136.4	52.0	-726.9
0.160	135	1870.2	-113.8	2.631	-0.1602	143.1	52.2	-607.7
0.170	136	1905.2	-95.7	2.680	-0.1347	141.8	51.7	-613.9
0.180	136	1950.1	-77.5	2.744	-0.1091	139.3	50.7	-678.0
0.190	136	1982.0	-54.5	2.788	-0.0767	131.2	46.8	-386.6
0.200	136	2033.1	-47.1	2.860	-0.0662	99.8	47.0	-380.4

FILE NO.=17
RUN#=82052002 X/D=5.25 ALPHA=0 BETA=0
NO.OF POINTS= 27

Y	TØ	U	V	U/A	V/A	USD	USD	U'V'
0.020	137	1266.6	-21.8	1.775	-0.0305	263.4	64.6	-8279.1
0.025	137	1382.3	-26.8	1.937	-0.0375	217.0	65.0	-7740.4
0.030	138	1438.7	-26.5	2.016	-0.0372	194.8	65.3	-6988.1
0.035	138	1480.8	-30.5	2.075	-0.0428	183.8	67.6	-6687.7
0.040	138	1507.8	-28.7	2.112	-0.0402	176.0	68.0	-6250.8
0.045	138	1541.5	-30.7	2.160	-0.0431	164.4	68.8	-6015.8
0.050	139	1571.3	-30.7	2.201	-0.0430	155.8	66.7	-5055.1
0.055	138	1598.4	-31.6	2.239	-0.0443	150.5	68.4	-4739.9
0.060	138	1623.5	-32.5	2.275	-0.0456	152.8	67.7	-4631.2
0.065	139	1650.2	-32.2	2.312	-0.0452	142.7	66.9	-4246.8
0.070	139	1666.2	-30.6	2.334	-0.0429	136.4	66.0	-3842.2
0.075	139	1689.2	-32.5	2.367	-0.0455	136.4	65.3	-3698.8
0.080	139	1718.1	-33.4	2.407	-0.0467	138.3	65.9	-3486.4
0.085	139	1739.4	-35.2	2.437	-0.0493	133.6	62.7	-3217.8
0.090	139	1759.6	-34.5	2.465	-0.0484	136.0	63.5	-3168.3
0.095	139	1780.3	-33.5	2.494	-0.0470	139.0	64.8	-3203.1
0.100	140	1811.2	-35.6	2.537	-0.0499	141.7	63.0	-3105.9
0.110	140	1862.0	-34.5	2.609	-0.0484	142.5	61.9	-2649.8
0.120	140	1928.8	-38.0	2.702	-0.0533	129.9	56.9	-2048.3
0.130	140	1987.0	-39.0	2.784	-0.0546	110.6	57.1	-1526.8
0.140	140	2033.5	-42.1	2.849	-0.0589	87.4	48.3	-814.6
0.150	140	2070.0	-41.9	2.900	-0.0587	67.6	48.5	-417.1
0.160	140	2097.3	-41.9	2.938	-0.0588	55.2	40.3	-261.2
0.170	140	2114.1	-42.3	2.962	-0.0592	51.5	42.1	-288.7
0.180	140	2130.3	-47.5	2.985	-0.0665	44.2	35.9	-97.7
0.190	140	2142.5	-47.2	3.002	-0.0661	38.3	43.1	-145.2
0.200	141	2148.9	-51.9	3.011	-0.0727	35.4	37.5	-35.9

FILE NO.=18
RUN#=82052004 X/D=4.39 ALPHA=2 BETA=0
NO.OF POINTS= 26

Y	T0	U	U	U/A	V/A	USD	USD	U'V'
0.025	139	1249.9	55.9	1.748	0.0782	219.0	57.3	-540.5
0.030	140	1256.4	45.3	1.757	0.0633	210.3	63.3	-1063.7
0.035	140	1284.0	55.4	1.796	0.0775	216.1	65.0	-1157.9
0.040	140	1318.2	65.2	1.844	0.0912	223.3	62.6	-1862.1
0.045	140	1339.3	70.9	1.873	0.0992	226.5	63.4	-1298.5
0.050	140	1367.9	79.6	1.913	0.1113	231.4	65.2	-1352.6
0.055	140	1414.0	88.5	1.978	0.1237	230.0	62.5	-1070.7
0.060	140	1438.9	95.9	2.012	0.1341	225.5	59.2	-652.6
0.065	141	1472.6	104.6	2.060	0.1463	219.9	59.0	-642.5
0.070	141	1497.8	117.7	2.095	0.1646	219.1	56.4	-548.8
0.075	141	1526.4	127.2	2.135	0.1779	217.3	53.4	-183.8
0.080	141	1556.7	136.0	2.177	0.1902	213.3	51.7	85.7
0.085	141	1583.4	145.5	2.215	0.2035	211.4	47.4	472.0
0.090	141	1608.9	156.2	2.250	0.2185	206.9	47.2	428.9
0.095	141	1648.7	164.5	2.306	0.2301	200.7	44.4	524.6
0.100	141	1673.9	172.1	2.341	0.2407	211.5	40.5	886.0
0.110	141	1745.0	187.3	2.441	0.2620	203.5	37.3	503.5
0.120	141	1823.2	197.4	2.550	0.2761	201.2	37.3	668.6
0.130	141	1920.1	207.9	2.686	0.2907	166.2	38.6	586.7
0.140	141	2004.8	210.2	2.804	0.2939	111.8	38.8	-79.3
0.150	141	2056.2	208.0	2.876	0.2909	66.3	38.2	-188.6
0.160	141	2076.1	200.6	2.904	0.2806	48.7	39.3	-114.1
0.170	142	2092.1	188.5	2.926	0.2636	44.3	43.3	-136.1
0.180	142	2105.8	175.0	2.945	0.2447	40.2	44.8	-126.4
0.190	142	2113.3	159.1	2.956	0.2226	39.3	48.6	-124.6
0.200	142	2121.8	144.7	2.968	0.2023	37.2	48.2	-142.1

FILE NO.=19
RUN#=82052006 X/D=4.7 ALPHA=2 BETA=0
NO.OF POINTS= 24

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.050	139	1482.7	-230.4	2.072	-0.3219	114.9	37.1	-1699.4
0.055	140	1499.5	-231.0	2.096	-0.3229	113.1	35.7	-1546.5
0.060	141	1522.5	-228.7	2.128	-0.3197	110.2	36.3	-1400.5
0.065	141	1534.9	-226.0	2.145	-0.3159	109.1	36.0	-1461.6
0.070	141	1553.4	-224.1	2.171	-0.3132	106.8	37.5	-1460.2
0.075	142	1569.0	-221.9	2.193	-0.3101	106.8	38.2	-1354.8
0.080	142	1582.0	-216.4	2.211	-0.3023	107.0	42.2	-1339.6
0.085	142	1595.3	-213.2	2.229	-0.2979	106.2	41.0	-1398.2
0.090	142	1603.1	-205.9	2.240	-0.2878	106.3	44.6	-1532.2
0.095	142	1613.0	-199.2	2.254	-0.2784	105.3	46.5	-1525.0
0.100	142	1626.3	-194.8	2.273	-0.2722	106.0	47.2	-1466.2
0.110	142	1643.1	-179.4	2.296	-0.2507	107.4	52.6	-1752.0
0.120	142	1660.1	-164.5	2.320	-0.2299	107.1	53.1	-1638.9
0.130	142	1683.1	-148.0	2.352	-0.2068	112.3	58.1	-1753.5
0.140	142	1707.5	-130.0	2.386	-0.1817	113.5	54.2	-1550.9
0.150	142	1733.1	-111.0	2.422	-0.1551	118.0	52.3	-1283.2
0.160	142	1762.6	-96.2	2.463	-0.1345	123.9	50.1	-1182.7
0.170	143	1790.8	-78.3	2.503	-0.1095	126.6	50.3	-1554.9
0.180	143	1832.2	-59.7	2.560	-0.0834	131.8	53.3	-1363.8
0.190	143	1872.2	-41.9	2.616	-0.0586	131.3	61.2	-1175.9
0.200	143	1911.7	-27.6	2.672	-0.0385	128.1	53.7	-1106.8
0.210	143	1947.7	-11.3	2.722	-0.0159	120.4	50.0	-826.4
0.220	143	1994.4	6.3	2.787	0.0089	105.0	48.9	-512.3
0.230	143	2030.1	21.1	2.837	0.0295	89.2	46.0	-459.9

FILE NO.=23
RUN#=82052307 X/D=5.25 ALPHA=2 BETA=0
NO.OF POINTS= 28

Y	T0	U	V	U/A	V/A	USD	USD	U/V'
0.025	143	1283.8	-26.4	1.790	-0.0368	205.9	65.0	-6910.1
0.030	144	1351.8	-33.9	1.884	-0.0472	187.6	64.7	-6207.3
0.035	144	1394.8	-34.5	1.944	-0.0482	172.2	66.9	-5688.1
0.040	144	1425.4	-35.7	1.987	-0.0498	168.5	68.5	-5476.3
0.045	144	1450.5	-33.7	2.022	-0.0470	161.9	68.6	-5446.0
0.050	144	1480.8	-32.9	2.064	-0.0459	156.1	69.6	-5683.1
0.055	144	1505.9	-33.4	2.099	-0.0465	154.6	69.5	-5283.6
0.060	144	1528.0	-33.6	2.130	-0.0468	152.3	70.6	-4735.2
0.065	144	1549.5	-34.4	2.160	-0.0480	145.8	69.4	-4573.0
0.070	144	1573.7	-33.3	2.194	-0.0465	142.9	70.3	-4898.5
0.075	144	1594.7	-29.8	2.223	-0.0416	137.6	65.7	-3890.0
0.080	144	1621.5	-29.9	2.260	-0.0417	135.4	68.1	-3864.0
0.085	144	1633.8	-28.6	2.278	-0.0399	132.2	67.4	-3871.8
0.090	144	1653.9	-27.1	2.306	-0.0378	135.9	67.0	-3524.1
0.095	144	1674.2	-25.7	2.334	-0.0358	130.5	66.3	-3704.8
0.100	144	1696.2	-23.6	2.365	-0.0330	127.9	65.4	-3176.5
0.110	144	1733.5	-21.5	2.417	-0.0299	129.0	65.6	-3364.5
0.120	144	1769.6	-20.6	2.467	-0.0287	127.4	65.8	-2790.3
0.130	144	1806.6	-16.7	2.518	-0.0232	128.3	67.3	-3052.4
0.140	145	1855.9	-16.4	2.587	-0.0229	125.3	63.5	-2593.0
0.150	145	1904.8	-18.2	2.655	-0.0254	121.4	60.5	-2469.3
0.160	145	1948.1	-19.3	2.716	-0.0270	108.1	57.5	-1865.0
0.170	145	1995.8	-19.8	2.782	-0.0277	91.3	55.7	-1451.1
0.180	145	2032.6	-22.0	2.834	-0.0307	77.3	48.6	-1125.2
0.190	145	2061.7	-23.6	2.874	-0.0329	68.2	48.1	-762.1
0.200	145	2088.0	-23.8	2.911	-0.0332	59.2	45.2	-442.6
0.210	145	2108.3	-23.6	2.939	-0.0329	54.9	47.1	-384.9
0.220	145	2128.2	-25.9	2.967	-0.0361	47.1	49.7	-197.7

FILE NO.=21
RUN#=82052008 X/D=4.39 ALPHA=-2 BETA=0
NO.OF POINTS= 23

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.025	140	1393.8	43.6	1.949	0.0610	209.4	59.1	-715.3
0.030	140	1394.5	36.5	1.950	0.0510	200.9	63.5	-601.8
0.035	140	1427.7	49.8	1.997	0.0697	207.5	62.2	-1477.0
0.040	141	1454.8	60.3	2.035	0.0843	213.0	61.3	-1180.4
0.045	141	1480.8	66.5	2.071	0.0931	218.5	59.1	-1791.7
0.050	141	1504.6	71.0	2.104	0.0993	216.9	57.8	-1618.0
0.054	141	1541.4	81.4	2.156	0.1138	219.7	54.1	-1517.6
0.060	141	1568.5	84.9	2.194	0.1188	225.4	52.3	-1198.2
0.065	141	1603.1	92.3	2.242	0.1290	224.6	48.8	-1124.9
0.070	141	1642.4	96.4	2.297	0.1348	231.1	50.0	-1337.8
0.075	141	1690.5	101.2	2.364	0.1415	216.9	49.6	-711.8
0.080	142	1720.0	105.9	2.406	0.1481	220.6	51.2	-721.2
0.085	142	1767.0	109.0	2.471	0.1525	206.4	54.5	-891.9
0.090	142	1800.4	110.7	2.518	0.1548	213.0	61.6	-848.5
0.095	142	1833.5	112.8	2.564	0.1577	204.5	65.6	-807.4
0.100	142	1879.6	111.5	2.629	0.1559	190.4	73.7	-393.3
0.110	142	1942.7	113.0	2.717	0.1581	169.8	69.7	-8.0
0.120	142	1997.7	114.2	2.794	0.1598	140.3	63.0	48.5
0.130	142	2040.1	117.4	2.853	0.1643	99.6	45.4	-110.4
0.140	142	2070.8	112.8	2.896	0.1579	55.5	37.1	-5.7
0.150	142	2081.2	109.7	2.911	0.1534	42.3	37.8	6.6
0.160	142	2084.9	102.4	2.916	0.1433	40.1	35.0	34.7
0.170	142	2089.4	96.8	2.922	0.1354	39.3	33.2	18.3

FILE NO.=22
RUN#=82052010 X/D=4.7 ALPHA=-2 BETA=0
NO.OF POINTS= 21

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.050	139	1638.5	-245.8	2.292	-0.3438	106.3	44.8	-1523.4
0.055	140	1658.4	-247.2	2.319	-0.3458	108.8	43.8	-1841.1
0.060	140	1673.0	-247.6	2.340	-0.3462	101.8	44.3	-1560.1
0.065	140	1688.3	-248.9	2.361	-0.3481	99.1	46.8	-1394.2
0.070	140	1702.4	-247.3	2.381	-0.3458	100.8	44.3	-1560.1
0.075	141	1713.3	-243.7	2.396	-0.3408	101.1	45.9	-1217.9
0.080	141	1725.4	-241.0	2.413	-0.3371	102.8	47.0	-1403.2
0.085	141	1734.2	-232.1	2.426	-0.3246	102.2	49.5	-1423.7
0.090	141	1742.6	-226.7	2.437	-0.3171	108.0	50.7	-1556.2
0.095	141	1747.1	-220.2	2.444	-0.3079	108.4	54.8	-1545.6
0.100	141	1762.3	-209.0	2.465	-0.2923	110.7	120.2	-1635.0
0.110	142	1783.8	-198.2	2.495	-0.2773	119.0	54.8	-1713.5
0.120	142	1812.9	-182.6	2.536	-0.2554	121.8	56.5	-1556.6
0.130	142	1836.5	-166.9	2.569	-0.2335	127.8	55.1	-1923.2
0.140	142	1873.2	-147.1	2.620	-0.2058	129.7	57.3	-1966.5
0.150	142	1908.0	-126.6	2.669	-0.1771	127.6	58.3	-1399.6
0.160	142	1945.5	-108.2	2.721	-0.1513	126.4	56.2	-1366.6
0.170	142	1980.2	-87.5	2.770	-0.1224	114.1	54.8	-1096.0
0.180	142	2021.6	-66.7	2.827	-0.0933	97.1	55.7	-613.3
0.190	142	2051.2	-47.6	2.869	-0.0666	80.8	52.3	-249.4
0.200	142	2077.7	-26.8	2.906	-0.0375	66.0	53.0	-167.6

FILE NO.=23
RUN#=82052012 X/D=5.25 ALPHA=-2 BETA=0
NO.OF POINTS= 26

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.025	138	1410.7	-27.0	1.973	-0.0378	265.5	65.3	-9507.0
0.030	138	1516.1	-41.9	2.121	-0.0586	203.2	63.2	-5616.0
0.035	139	1554.8	-39.9	2.175	-0.0558	188.7	63.7	-4643.5
0.040	139	1592.9	-40.7	2.228	-0.0589	179.8	65.4	-5047.8
0.045	139	1629.5	-43.1	2.279	-0.0603	168.8	65.3	-4275.0
0.050	139	1658.3	-44.7	2.319	-0.0626	160.2	65.5	-4135.8
0.055	139	1680.7	-44.9	2.351	-0.0629	156.9	64.9	-3606.9
0.060	139	1714.3	-45.1	2.398	-0.0631	152.1	64.5	-3648.4
0.065	139	1744.9	-46.9	2.441	-0.0656	152.2	62.1	-3045.5
0.070	139	1766.1	-45.7	2.470	-0.0640	148.7	62.7	-3146.5
0.075	140	1797.9	-47.6	2.515	-0.0665	157.6	61.7	-3259.0
0.080	140	1838.9	-47.3	2.572	-0.0661	147.6	62.2	-3152.3
0.085	140	1863.5	-48.7	2.606	-0.0681	146.5	60.4	-2780.6
0.090	140	1893.8	-49.5	2.649	-0.0692	140.2	57.0	-2480.1
0.095	140	1923.5	-49.5	2.690	-0.0692	138.9	54.6	-2353.2
0.100	140	1945.4	-49.6	2.721	-0.0693	133.7	55.8	-2056.3
0.110	140	2014.4	-52.8	2.817	-0.0738	101.8	52.8	-1113.6
0.120	140	2058.9	-52.9	2.880	-0.0740	76.0	47.5	-831.0
0.130	141	2090.5	-55.4	2.924	-0.0774	59.2	42.9	-464.1
0.140	141	2110.6	-56.4	2.952	-0.0789	49.1	40.7	-219.2
0.150	141	2125.8	-59.8	2.973	-0.0836	40.4	35.6	-143.0
0.160	141	2138.1	-65.3	2.990	-0.0913	36.6	36.8	-25.2
0.170	141	2144.4	-68.8	2.999	-0.0963	38.1	36.6	-29.9
0.180	141	2147.1	-72.9	3.003	-0.1019	33.1	40.1	0.0
0.190	141	2148.9	-77.7	3.006	-0.1087	33.2	30.7	16.7
0.200	141	2151.0	-79.7	3.009	-0.1115	34.4	40.7	6.8

FILE NO.=24
RUN#=82052013 FREESTREAM ALPHA=0 BETA=0
NO.OF POINTS= 3

Y	T0	U	V	U/A	V/A	USD	VSD	U'V'
0.200	138	2136.2	-4.3	2.995	-0.0060	19.1	31.7	20.3
0.200	138	2137.1	-5.1	2.997	-0.0071	20.1	31.4	30.0
0.200	138	2138.2	-5.1	2.998	-0.0072	21.3	31.6	36.4

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